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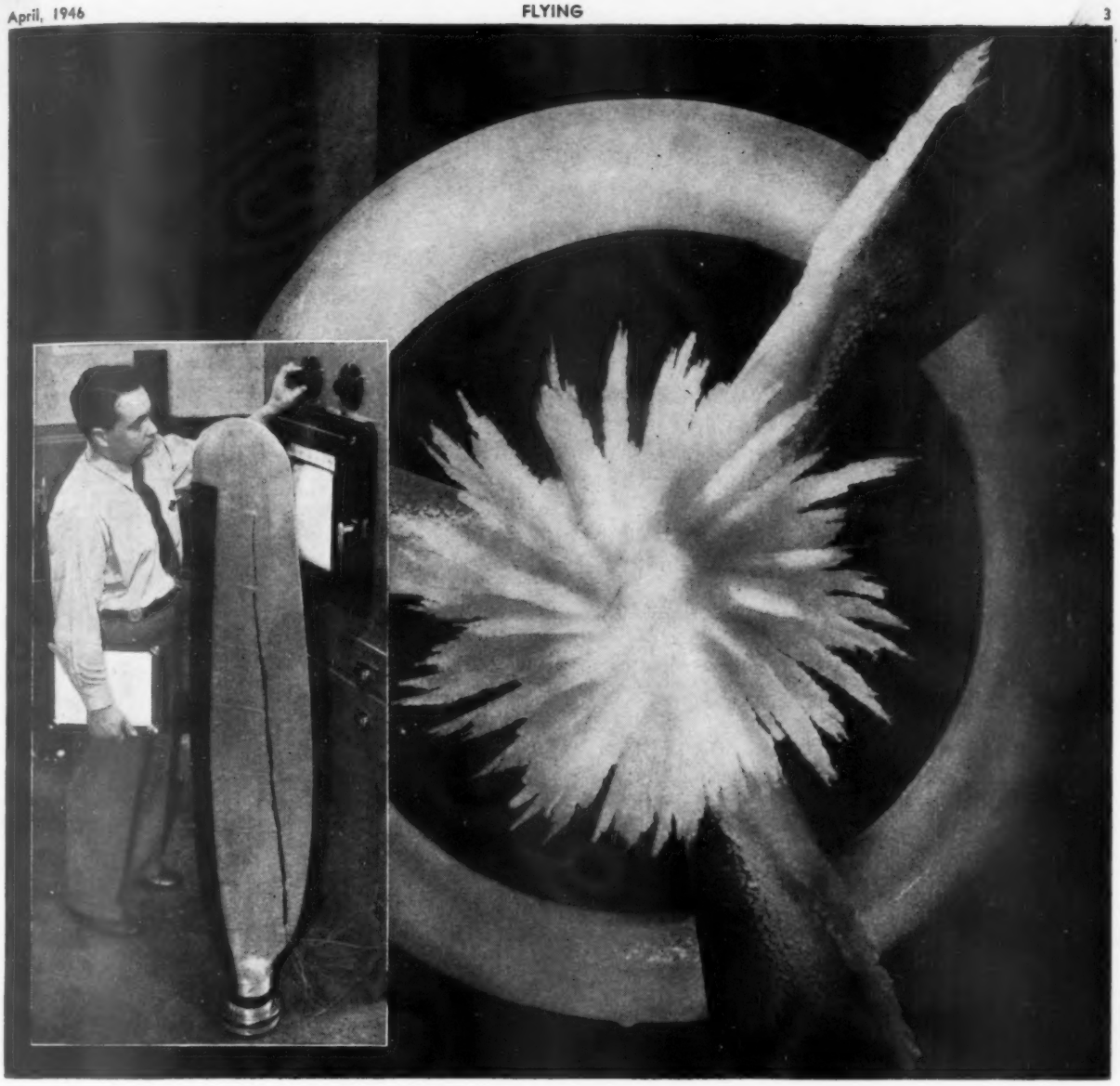

Push-button defrosting for planes

AN 80-MILE WIND, roaring through the B. F. Goodrich refrigerated wind tunnel, created the Jack Frost effect on the propeller model above.

The exaggerated ice flower on the hub isn't as serious as it looks; but fingers of ice, creeping up the blades, were a big worry to pilots for years. For in flight, ice on the blades means loss of power, bad balance, and excessive vibration.

To a pilot, the smaller picture looks a lot better. It's a propeller equipped with a new B. F. Goodrich development called an electrically heated propeller shoe. It's shown here being tested (the wires are part of the testing equipment; they are not on the blade in flight).

With these shoes on his propeller blades, a pilot can defrost them as simply as a housewife defrosts a refrigerator . . . and lots quicker. The pilot just touches a switch and electric current begins to generate heat in the shoe, which melts off ice.

B. F. Goodrich equipment protects many other parts of the airplane from ice. Best known are the De-Icers, which crack ice off as it forms on wings and tails, keeping these surfaces clean and smooth for safer flying. De-Icers were developed and are made exclusively by B. F. Goodrich.

Years of ice-fighting experience are back of this equipment. It means a safer, more comfortable flight if you fly today or when you fly tomorrow. *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

Skyway or Highway

B.F.Goodrich

FIRST IN RUBBER

FLYING

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APRIL • 1946

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THE COVER

Unusual feature of the experimental Culver Model V is what its engineers call "Simplifly" control. Flap and stabilizer are interconnected and controlled by a device on the instrument panel which automatically trims the plane for any condition of flight, and governs speed. The Model V is essentially a two-control plane in the air and rudder is unnecessary except in cross-wind landings. The plane is powered by an 85-h.p. Continental engine.

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$348,000,000 for military plane research in 1946.

Commercial airliner designs now ready for 1950.

Any Hope for the Private Plane?

AOPA Manager Hartranft, until recently a lieutenant colonel in the AAF.

Asks J. B. HARTRANFT, Jr.

General Manager, Aircraft Owners and Pilots Association

EDITOR'S NOTE

In the interest of free discussion in the aviation industry, we publish here an article by an official of the largest organization of pilots and plane owners in the country. We do not necessarily agree with Mr. Hartranft's statements. We have requested representatives of the aviation industry to present their case in an early issue.

IF THE lightplane becomes buyable and flyable for the mass market in the foreseeable future much greater strides in research and development will have to be made. For very little is being done to improve present models and develop new ones at the moment.

These are hard words, but they are based on even harder facts dug up in an exhaustive coast-to-coast survey made by outstanding experts in the lightplane field.

The three groups known to be most interested—the National Advisory Committee for Aeronautics, the Civil Aeronautics Administration, and the lightplane industry—are all committed, for instance, to improving the lightplane till increasingly large numbers of people can buy and fly it.

Officials of NACA, the Government agency responsible for pure research in aviation, have repeatedly emphasized the need for conversion from their war-time (and spectacularly successful) activities, to research in the peacetime field of transports and putt-putts.

CAA, whose administrator is "empowered and directed to encourage and foster the development of civil aeronautics," has come out strongly and repeatedly for "basic research looking toward improvement of personal aircraft."

The industry not only is committed to a crusade for bringing flying to the masses (repeatedly predicting that the plane for such flying is just around the corner), but has outlined a specific research program. This outline came in response to a query from The (*Continued on page* 90)

Naval Aviation TOMORROW

By Vice Adm.
MARC A. MITSCHER
Commander, 8th Fleet, Formerly Deputy Chief of Naval Operations for Air

THE U. S. Navy's fleet air arm, which played such a predominant role in smashing the Japanese from Guadalcanal to Tokyo, will continue its world leadership in scientific and technical research during the post-war era. Some of the new developments will make Buck Rogers look as backward as the Neanderthal man.

Experiments in radically new types of piloted aircraft, radio controlled planes, new methods of propulsion, fuel and aerodynamic principles are a few of the projects on which Naval aviation is engaged.

We are vigorously pursuing the development of jet-propelled aircraft, pilotless planes and guided missiles. Navy fighters of the future, faster than sound, probably will be powered by turbo-jet engines, possibly with rocket equipment for short bursts at extremely high speed.

Another promising development is the composite power plant, a combination of the conventional reciprocating engine and jet. Such a transitional power plant would be used in dive bombers, torpedo bombers and long-range patrol planes. It is probable that the ultimate development in this category will be the propeller-driven gas turbine rather than the pure turbo-jet.

In the realm of guided missiles a completely new field of propulsion is under investigation. Resojets, ramjets, liquid-jets and turbo-jets, all viewed with favor by aviation planners, will attain super-sonic speeds.

When V-J Day arrived, the Navy already was launched on an extensive program for pilotless aircraft. A few of the new developments removed from the restricted list are *Glomb, Gorgon and Gargoyle* which are just as deadly as they sound.

The *Glomb*, a glider bomb, carries a 4,000-pound load of high explosive and can be towed by a Navy fighter plane. When released from the fighter it is directed to its target through radio control and television.

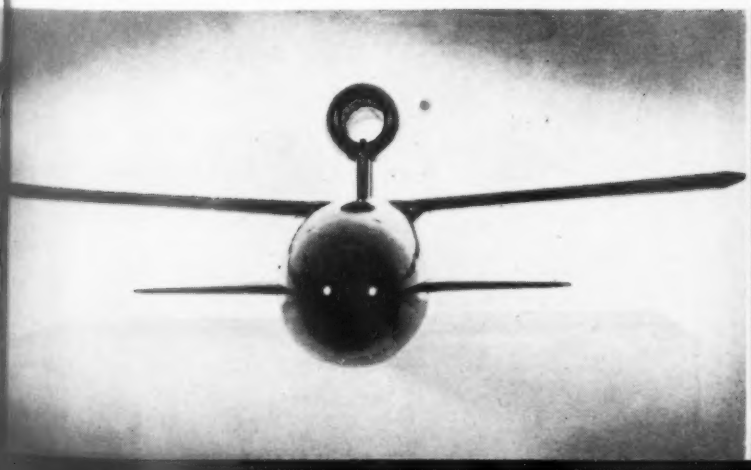
The *Gorgon* is a jet-propelled aerial missile which can be carried to a point near the intended target by a bomber and then released. Flight control is then given by radio or by its own automatic target seeking de- (*Continued on page* 92)

New McDonnell Phantom has two axial-flow turbines, is first Naval carrier-borne fighter to exceed 500 m.p.h.

Research keynotes the Navy's post-war air plans. Emphasis will be on electronics, rockets, and guided missiles.

Ryan Fireball, with conventional engine in nose and jet engine in the rear, exemplifies Navy's experimental-minded attitude on new developments.

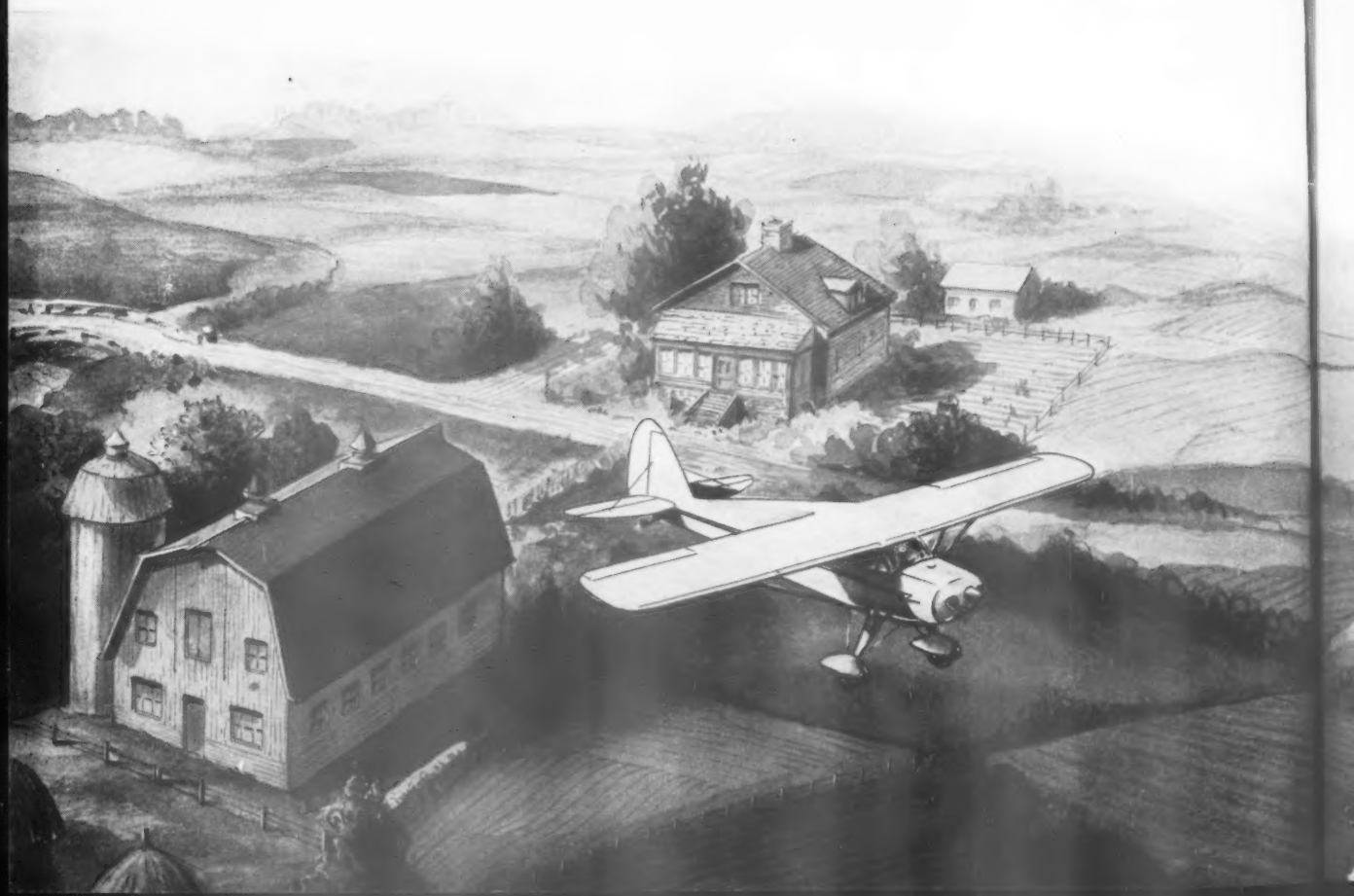
Gorgon is guided missile carrying 1,000 pounds of explosive.



Rocket bomb carries 100-pound charge at 550 m.p.h.

The Farmer Takes

Farmer-flyers of Vermillion include (from left) Orville Brown, Mrs. J. Skinner, "Red" Johnson, Robert Clingan, Volkel.



a Plane

By W. E. RENSHAW
Indiana Editor, The Prairie Farmer

Indiana's flying farmers are a potent sales force in their state for private flying.

First farmer in his county to own a plane, Ellis Volkel and his wife now have an airport on their farm.

Dean Wakefield, Hosdreg airport manager, instructs pupils Garnet Fuller, 16 (left) and William Ballard, 17.

A GROUP of Indiana farmers who have taken up flying in the past couple of years have already found that the airplane is so valuable in their business as to be practically indispensable. They are learning that, to quote one of them, "the airplane is just another machine necessary to successful agriculture." As a consequence, scores of new planes are on order in this area, several hundred people are learning to fly, and aviation is coming into its own among a group who can use the speed of flying machines to eat up long rural distances.

Paul Thompson, of Vermillion County, has extensive fa- ing and cattle feeding operations. "When my office phone is ringing I can't afford not to be there," he explains. His two airplanes are the only way he can keep in touch with his extensive farming activities without being away from his headquarters for more than a few hours.

Recently Thompson had a long distance call from his foreman at Lexington, Ky., where he was feeding 800 cattle on distiller's slop. The cattle were seemingly afflicted by a mysterious malady. Many had fallen down and were unable to get up. Some were blind, others paralyzed. Thompson flew down immediately. Speed of his trip enabled him to find the trouble quickly enough to remedy it without losing a steer.

"Before I bought my first plane I probably would not have been at home when that call came in," Thompson explains. In the old days a trip to Kansas City, 385 miles distant, would have taken at least three days. Now Thompson often has breakfast at home, flies out and buys several carloads of feeder cattle, and is back home for his evening meal.

Thompson owns a twin-engined Cessna *Bobcat* and a Fairchild *Cornell*—larger and faster planes than most farmers need. But his interest in aviation is no more intense than that of hundreds of his neighbors. A few miles north of his home, farm folks in Highland Township are taking to the air with a vengeance. Already a half dozen farm families own their own airplanes and 22 more have their orders in for new craft.

The log books show that in the few short months this farm airport has been open, 68 pupils have signed up for flying lessons—90 per cent of them farm folks. Ask these rural pilots whether there is a place in agriculture for aviation and they'll snow you under with answers. Logical ones, too.

Perhaps the biggest reason aviation has taken such a quick hold in northern Vermillion County is that folks don't have to go to town to hangar their planes, thanks to the industry and ingenuity of farmer Ellis Volkel. Some two years ago Volkel bought his first plane and, after learning to fly, suddenly realized that he had to drive to distant Danville, Ill., to hangar it.

Color photographs taken by Walter Rusk (right) from plane flown by Dean Wakefield (left) have helped soil conservation.

Sixteen-year-old Louise Egley of Wells County spent last summer driving a tractor to earn money for her flying lessons.

Paul Thompson of Vermillion County flies this Cessna Bobcat and a Fairchild Cornell in his farming and feeding business.

When more and more neighbors began to show an interest, Volkel asked, "Why not devote some 20 acres of our 240 acre farm to an airfield?" His neighbors agreed that it was a swell idea—and that is how aviation came to Highland Township, Vermillion County, Ind.

Work was started immediately. The hangar was mostly built in Volkel's farm shop. Rough spots in the field were leveled off and on August 23, 1944, the field was designated as Landing Area 3412 by the CAA. Kenneth Johnson, a former primary and basic flying instructor with the air forces, was hired as instructor and the airport was ready for business.

Business wasn't long in coming either. More than two dozen farmers soloed during the first year, with at least half of them obtaining their private licenses. Flying wasn't confined to the men alone. Orville Brown and Bob Clingan were soon encouraging their wives to fly and today almost as many women as men are interested in flying at the Highland port.

Volkel and the other farmer-flyers who use the airport believe that the plane may some day equal the automobile as a farm necessity. Volkel answers the query, "What business has a farmer with an airplane?" with a stock reply: "No more business than he had with an automobile 35 years ago."

Gerald Morgan, one of the first farmers to buy a plane, expects it will help him in buying feeder cattle. "If I don't find what I want at the stock yards in Kansas City, I can fly right on out to the plains of Wyoming or Montana," he explains.

In flying west to buy cattle Morgan and other cattle feeders will be following a trail blazed by Paul Thompson who has already proved that flying is particularly adapted to this branch of agriculture. Between April 11 and June 14, 1945, Thompson flew 118 hours on business alone, covering an estimated 12,980 miles. Thompson has been feeding out about 7,500 head of cattle per year during recent years and has used a plane extensively since 1939. The afternoon Thompson bought his first plane he flew to Kansas City and bought 600 head of cattle.

The farm plane is expected to be widely used in getting emergency repairs for farm equipment. When a farmer has a breakdown during the rush season and discovers that his local dealer doesn't have the part in stock, he'll simply call the branch or perhaps the factory, fly over, pick up the repairs, and what once would have meant a breakdown of several days will be a shut down of only hours.

L. K. Wyckoff of Porter County agrees with Volkel. Wyckoff who farms 600 acres and has had his own plane for some two years, recently demonstrated conclusively his plane's value in getting such repair parts. When a fan shaft broke on one of the Wyckoff tractors during a rush, Wyckoff called the factory but was told that, because of tight shipping conditions, they couldn't guarantee delivery short of three weeks. They said, however, that he could have the part that afternoon if he would come and get it.

Two hours 15 minutes after leaving home Wyckoff set his Taylorcraft down at the factory 190 miles away, picked up the part, and was back home before sundown. The tractor was back in operation by the next morning. "My T-craft's gasoline consumption," Wyckoff adds, "was slightly less than I would have used by auto."

A producer of hybrid seed corn, Wyckoff recently used his plane to fly to the Rio Grande Valley where he has an experimental plot of corn. Going by way of Des Moines to pick up a passenger, he made the trip to Texas in 17 hrs. 10 min. Coming back direct, his flying time was 14 hrs. 50 min. Wyckoff believes that up to 10 per cent of midwestern farm families will own planes within five years.

Volkel sees the farm plane being used for many of the tasks now performed by the automobile. He tells how he used his plane this past year to help combine wheat, flying when the lanes were too muddy to drive over.

In this rural Indiana are hundreds of farm boys and girls are learning to fly and every one of them is anxiously awaiting the day when he can own his own plane. In Huntington County, energetic Dean Wakefield, manager of the Hosdreg Airport, flies out to high schools in adjacent counties to give flying lessons to farm boys and girls.

A nice pasture field near the East Rock Creek Center School in Wells County made it possible for Wakefield to teach flying to Garnet Fuller, 16, William Ballard, 17, and Louise Egley, 16, almost in their own backyards. Every Saturday forenoon last summer Wakefield would fly over *(Continued on page 11b)*

Queen OF THE TRANSPORTS

Dependable, versatile, an Army C-47 takes off with a CG-4A cargo glider.

Created almost accidentally, the wonderful DC-3 became the standard air transport for peace and war.

By Lieut. Col.
PAUL H. HOWE
as told to
LOUIS BANKS

TO COMPARE people with airplanes is a risky device.

Yet so many men feel genuine affection for the Douglas Commercial model 3 that its life history can best be written in the terms we save for great heroines.

In that low-wing, twin-engined transport there is much that is as American as Abe Lincoln: a plain, honest background; a simple, humble beginning; careful tempering and testing in early life—and capability and performance beyond the dreams of its parents.

The gleaming DC-3 of the airlines and the C-47, C-53 and R4D in warpaint—a total of 10,926 Airplanes in all—have made the whole world think of air transport as synonymous with that wide, swept-back Douglas wing. But the DC-3 is all things to all men. To a malaria-shivering Marine on Bougainville she was an ambulance that lifted him to a land of nurses and clean sheets; to a paratrooper poising at her door over Germany she was the last contact with the U.S.A.; to a three-star general she was a floating office that flew him through storm and turbulence to important Washington conferences.

And to pilots of 32 different nations she was the plane that flew herself better than they could fly her, that took the punishment of rough runways, of updrafts, of full-power short take-offs, of

single-engined flight, of staggering overloads without faltering.

To Donald Douglas and his veteran associates she is something else completely: she was born because a progressive airline couldn't squeeze berths into his DC-2; a child so precocious that she smashed the career her parents had planned for her and emerged from their factories in a hundred different, varied forms—and a child so sturdy that she carried the Douglas Aircraft Corporation through the depression and aided the expansion and research on her more glamorous warplane sisters.

Douglas engineers had poured a golden bounty of money and talent into their first passenger-carrying venture in 1932 and 1933. This was the DC-1, designed to fill a demand for a quiet, comfortable, warm mode of air transportation to succeed the Fokkers and the Ford trimotors. Because the field was new for Douglas, the research was painstaking. Because he wouldn't skimp on strength and durability, the DC-1 weighed 3,000 pounds more than he had thought she would. The low wing was chosen as a safety factor—it helped to shield the passengers on belly crashes and made a better housing for a retractable landing gear.

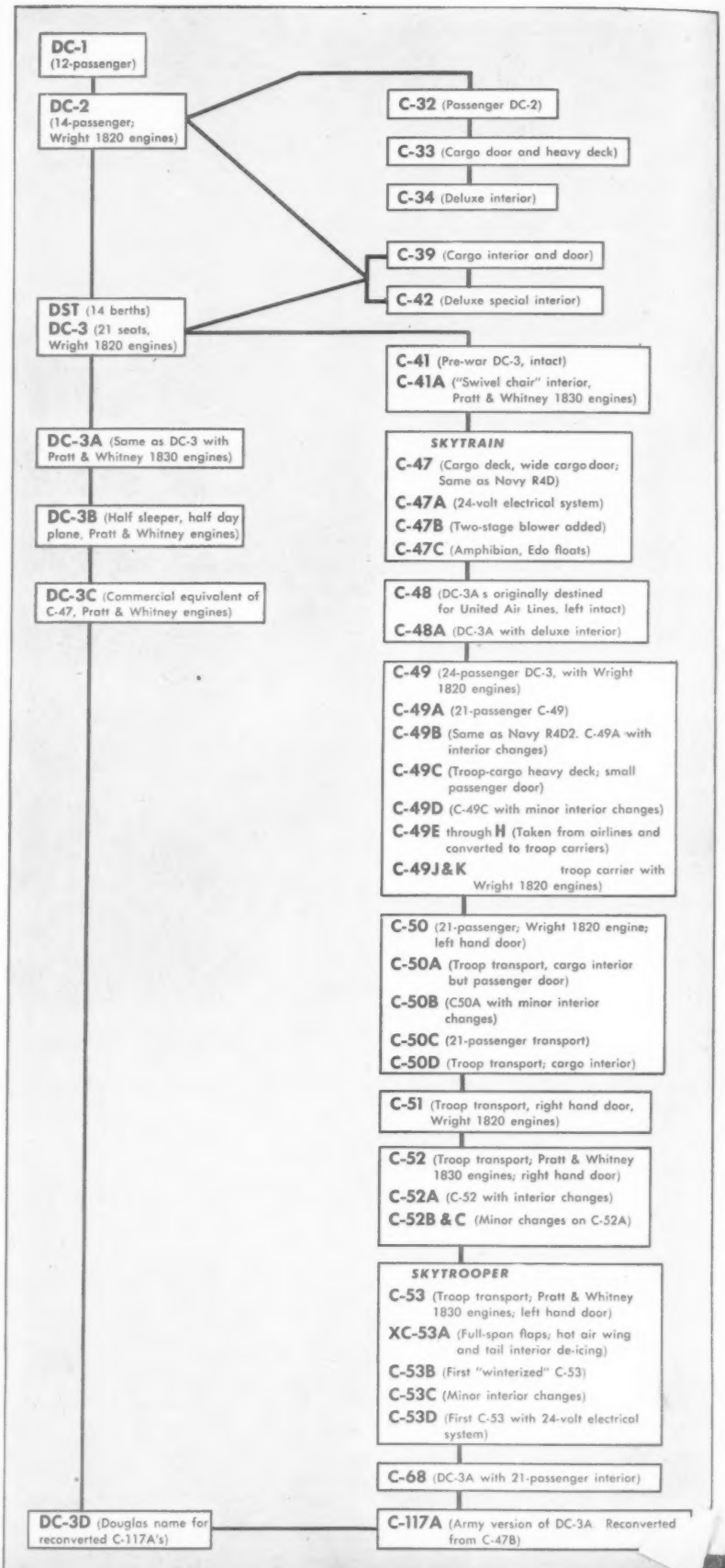
The prototype was a success and went into production with minor changes as the DC-2 on an order from Transcontinental & Western Air. By 1934 TWA was operating a fleet of these 14-passenger, 1,420-h.p. planes and others were ordering fast. But American Airlines decided it needed a sleeper plane on its southern run across the country and put the problem up to Douglas.

Fred Hermann, the project engineer, and his cohorts strained and stretched, went to the Pullman company for ideas, contacted inventors, and mulled their brains. But try as they might they could not squeeze a comfortable berth into the narrow fuselage of the DC-2. So the wider, circular fuselage of the DST (Douglas Sleeper Transport) was designed to hold seven upper and seven lower berths. Then someone discovered that, as a dayplane sans berths, three rows of seats could be fitted into the DST's space. So she became the DC-3 to carry 21 passengers and later as many as 28. The DC-2 wing center section was left pratically the same, a pointed tip was added to increase wing surface, and the stabilizers were expanded. On December 18, 1935, the first DC-3 was completed and Carl Cover, then chief test pilot for Douglas, took her up on engineering tests.

Two basic facts about her slowly became apparent: she was fundamentally well-designed—safe, sound and beautiful; second, she was timely. She had been created in time to utilize the adjustable pitch propeller on her Wright 1820-G2E —and later Wright 1820-G102A and Pratt & Whitney 1830—engines. This was a great economy factor in operation. She was a travel incentive to the rising generation of air-minded passengers; she was equipped to fly through weather as no airplane before her; she was warm and she was quiet. She was ready for her time and the time was ready for her.

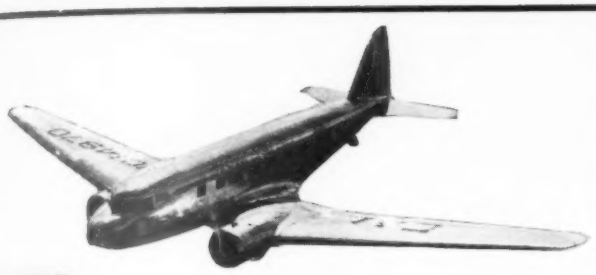
The first of American Airlines' 20 plane

DOUGLAS COMMERCIAL-3

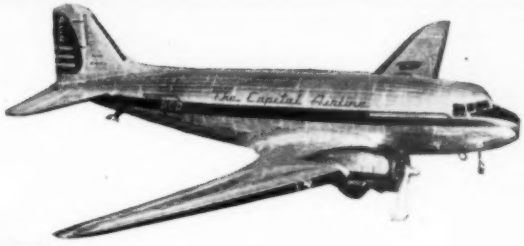

DC-1 (12-passenger)
DC-2 (14-passenger; Wright 1820 engines)
C-32 (Passenger DC-2)
C-33 (Cargo door and heavy deck)
C-34 (Deluxe interior)
C-39 (Cargo interior and door)
C-42 (Deluxe special interior)
DST (14 berths)
DC-3 (21 seats, Wright 1820 engines)
C-41 (Pre-war DC-3, intact)
C-41A ("Swivel chair" interior, Pratt & Whitney 1830 engines)
DC-3A (Same as DC-3 with Pratt & Whitney 1830 engines)
SKYTRAIN
C-47 (Cargo deck, wide cargo door; Same as Navy R4D)
C-47A (24-volt electrical system)
C-47B (Two-stage blower added)
C-47C (Amphibian, Edo floats)
DC-3B (Half sleeper, half day plane, Pratt & Whitney engines)
DC-3C (Commercial equivalent of C-47, Pratt & Whitney engines)
C-48 (DC-3A s originally destined for United Air Lines, left intact)
C-48A (DC-3A with deluxe interior)
C-49 (24-passenger DC-3, with Wright 1820 engines)
C-49A (21-passenger C-49)
C-49B (Same as Navy R4D2. C-49A with interior changes)
C-49C (Troop-cargo heavy deck; small passenger door)
C-49D (C-49C with minor interior changes)
C-49E through H (Taken from airlines and converted to troop carriers)
C-49J&K troop carrier with Wright 1820 engines)
C-50 (21-passenger; Wright 1820 engine; left hand door)
C-50A (Troop transport, cargo interior but passenger door)
C-50B (C50A with minor interior changes)
C-50C (21-passenger transport)
C-50D (Troop transport; cargo interior)
C-51 (Troop transport, right hand door, Wright 1820 engines)
C-52 (Troop transport; Pratt & Whitney 1830 engines; right hand door)
C-52A (C-52 with interior changes)
C-52B & C (Minor changes on C-52A)
SKYTROOPER
C-53 (Troop transport; Pratt & Whitney 1830 engines; left hand door)
XC-53A (Full-span flaps; hot air wing and tail interior de-icing)
C-53B (First "winterized" C-53)
C-53C (Minor interior changes)
C-53D (First C-53 with 24-volt electrical system)
C-68 (DC-3A with 21-passenger interior)
DC-3D (Douglas name for reconverted C-117A's)
C-117A (Army version of DC-3A. Reconverted from C-47B)

AND ITS FAMILY TREE

DC-1

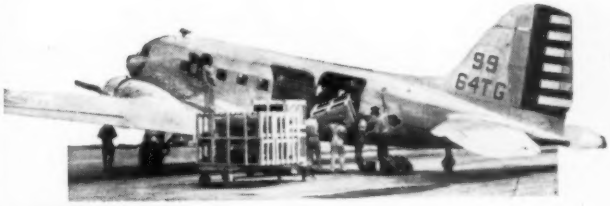


DC-2

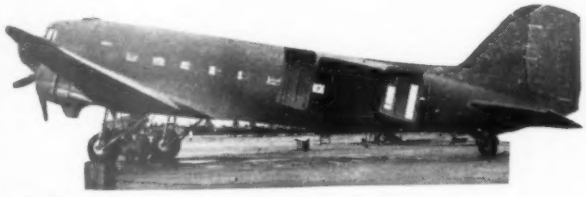


DC-3

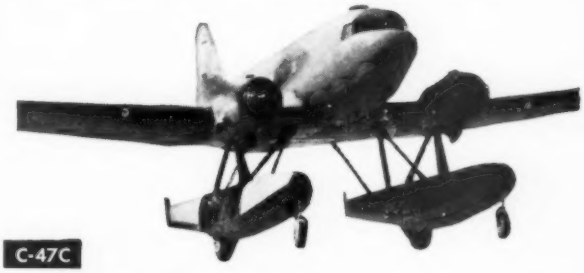
C-33



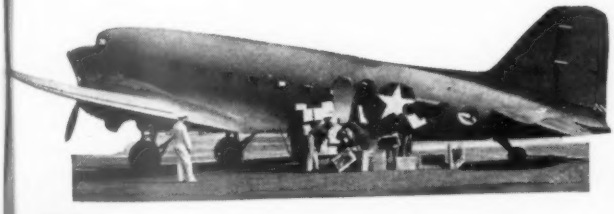
C-39



C-47



C-47C



C-53

C-117A

Skytrains of the Troop Carrier Command bank over their airstrips after a European operation. Thousands of these planes were used as freighters to haul men and supplies.

order went into service in June, 1936, on the 750-mile nonstop New York-Chicago run. Pan American, TWA, United Air Lines, Eastern Air Lines, and K.L.M., the Dutch system, sent their senior pilots to Santa Monica, Calif., to wangle demonstration time. Rate of production at the Douglas plant was the only governor on the speed with which the DC-3 became standard equipment on the major U.S. airlines. Anthony Fokker gave up airplane manufacture and secured rights for sale of the plane in Europe.

The DC-3 had other new admirers too —admirers in khaki who were destined to be more in her life than anyone could dream. The Army had bought 18 of the DC-2s and dubbed them C-32s in passenger form, and C-33s as cargo-transports. They took another, installed a dural deck and called it the C-34. Then, in a sales maneuver that still makes Douglas engineers smile, they were sold 36 C-39s—a sort of "DC-2½" with a DC-2 fuselage, DC-3 wing root and center section, DC-2 wingtips and DC-3 landing gear and tail section. Next Army requisition was the C-41, a full-fledged, pre-war DC-3. Two of these were delivered.

It was a mature DC-3 that was rolling off the Santa Monica assembly lines in the months before the war. In fact, old age seemed not too far distant, for the four-engined Douglas transports already were in mockup stage and competitors had their engineers busy on commercial models they thought would soon retire the DC-3 to the pastures with Fokkers and Fords. But when air force orders rained down on the Douglas roof the DC-3 was the only sizeable transport-cargo plane in the field with a backlog of commercial and military experience, the only one with all the "bugs" worked out.

(*Continued on page* 110)

Hitched to Waco CG-4A gliders filled with airborne infantry, Skytrains, themselves loaded with paratroopers, await take-off. Units of the 1st Allied Airborne Army, in this operation last March, were dropped over the British 2nd Army front in Germany.

'BOMBER' POWERS

By MARVIN C. WACHS

Carefully hush-hushed during wartime, bombing feats of AAF's top ace are almost unbelievable.

RECORDS are ridiculously incomplete concerning the man who was probably the Army Air Forces' top pilot, Capt. Roger Powers. Chief reason for this is that many of the Powers achievements left AAF red tape so tattered that the brass hats thought it wisest just to forget them. Take the bombing mission Powers flew attired immaculately in top hat and tails . . . but that story can wait a bit.

Despite calculated oversight on the part of AAF officialdom, much more would have been known about Powers had it not been for the respect felt by all those who knew him for his consummate sense of modesty, a character trait shared, in somewhat lesser degree, by most men who have served in the bomber command. Actually, Powers is one of the few AAF pilots who has granted only one press interview (reported in the August, 1945, issue of FLYING). With a bomber pilot's usual reticence, he chose on that occasion to relate only some ATC experiences accumulated during his one brief rest from active duty.

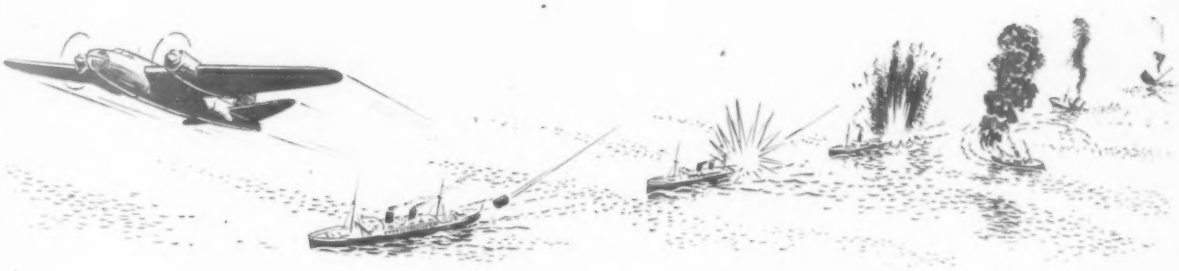
Now that Powers is out of the service, his activities are likely to be shrouded in greater secrecy than ever. Only a few of those in the know will hint that recent radar contacts with the moon were only subsidiary to Powers' studies on radar-controlled interstellar flight. Until such far-flung activities can be reported, there is little the historian can do but piece together the most important phase of this aviation pioneer's background—his hitherto unheralded achievements in the AAF bomber command.

Powers did his first combat tour in the South Pacific. His only true love was his old *Marauder*. For Powers she behaved in the best lightplane style. His exploits in "The Slot" made history at the time.

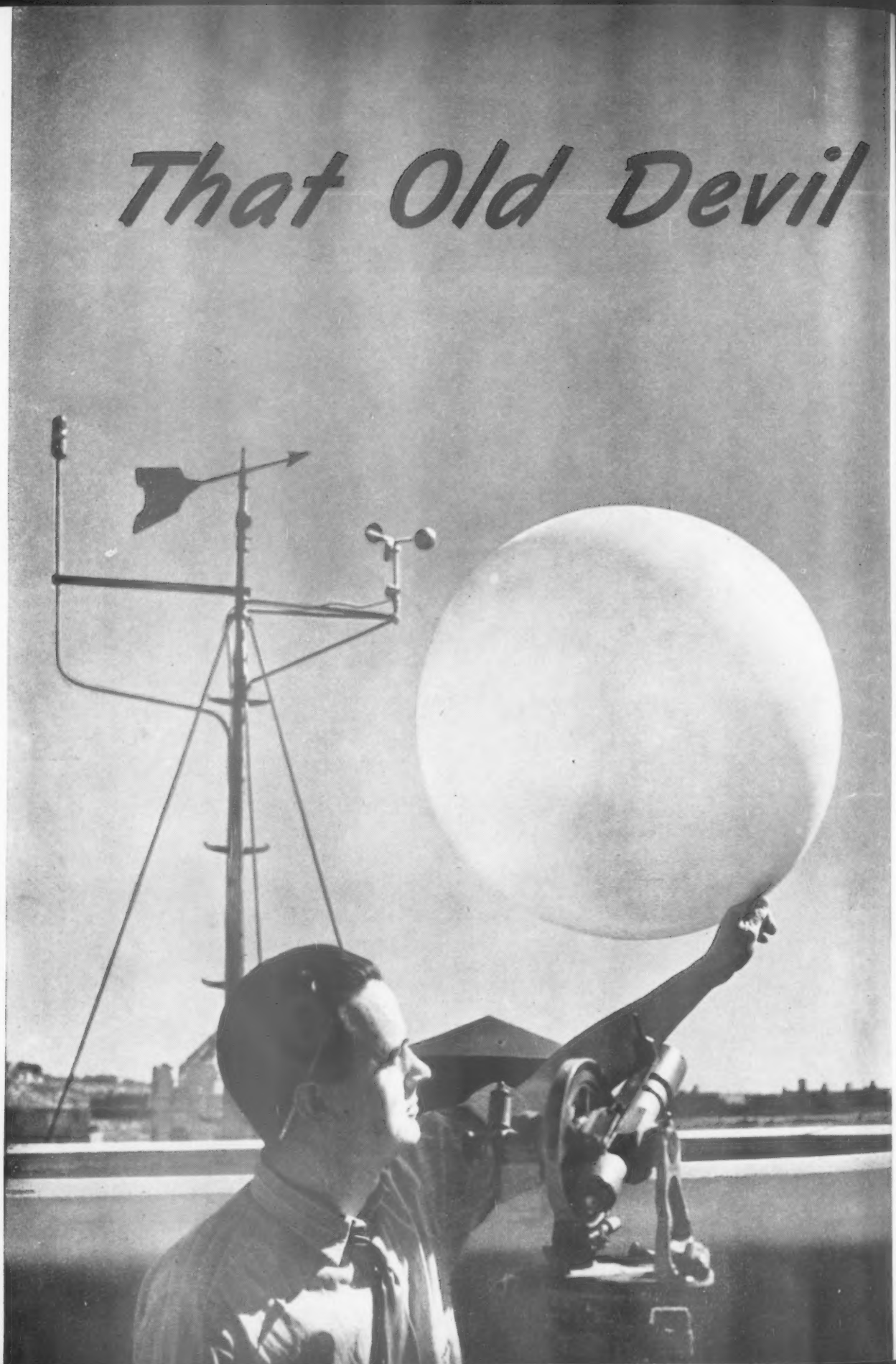
Old "PX" Powers we called him in those days. No one knows precisely how he got the name, but it is believed to stem from his dislike for spending successive nights at one field. Habitually,

(*Continued on page* **113**)

Precision and uncanny timing gave Powers a six-ship strike, one of many feats which the AAF chose to ignore.



That Old Devil



WIND

Percentages are against the pilot who gambles with the wind. Here are some hints on how to beat it.

By CREIGHTON MERRELL

THAT Old Devil Wind—he just keeps blowing along. High in the stratosphere, seven miles and more above the earth, he thunders along free of clouds and convective currents from the earth. His paths are swift and sure, his energy tireless, his supremacy complete.

Farther down, down in the levels of the troposphere, his movements are ever changing. His environment is that of clouds and storms and fair weather. Hot spots on the earth send up billowing masses of heated air which create huge waves in his path. Storm centers develop into which he rushes with violence and fury. In these levels, his ways are fitful, restless and his course constantly varies in direction and speed.

Closer still to the surface of the earth Old Devil Wind is a tortured whining thing. Friction with the earth's surface slows down his pace. He travels its contours grudgingly, climbing over hills and rushing down into valleys, sighing as he goes.

It is best to reckon well with Old Devil Wind and to learn his ways carefully—he is the biggest single problem in all of air navigation. It takes only ordinary skill to point an airplane in the right direction and keep account of the speed reading on the instrument panel. But it takes a skillful navigator to understand the vagaries and changing moods of Old Devil Wind and to make allowances for what he can do.

Changes in the wind during any flight may result in undershooting or overshooting the destination or may mean being blown completely off the course. Any of these conditions might prove disastrous—that's why a regular check and allowance for the wind throughout the flight is necessary.

Misconceptions about the effect of wind are so common among men in all branches of aviation that none should feel above re-examining the subject. Some of the darnedest arguments have arisen about it—some of the weirdest proposals have been made concerning it.

For instance, there are those who argue that skinny planes like the Lockheed *Lightning* will be drifted off course less than a big deep airplane like a Boeing *Clipper*.

Others suggest that a weather vane should be placed ahead of the pilot's windshield so he can see how much he is drifting or crabbing into the wind.

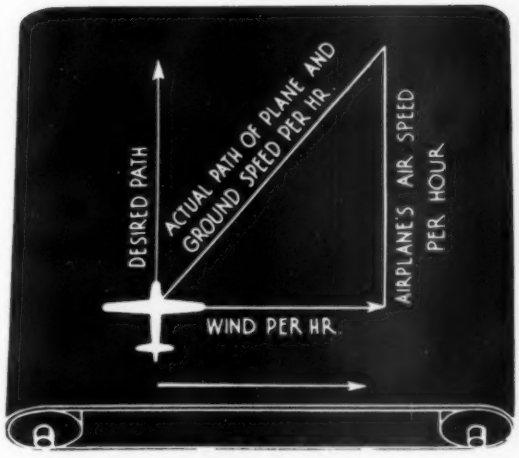
Others say an airplane flying downwind should have the flaps and landing gear down to catch more of the tailwind.

Then there is the old, old argument that an airplane making a 180° sharp turn from a headwind to a tailwind will lose practically all speed and will stall.

To gain a proper conception of the effect of wind it must first be realized that an airplane in flight is a part of the air ocean in which it is operating. The movement of air masses

←

Basic tools used in wind mapping are weather vane, anemometer, aerial balloon and the theodolite for tracing its course aloft.



Drift is illustrated by rolling toy plane across a moving belt. Speed of its movement determines course.

Correction is illustrated by setting plane's course so that its movement counteracts that of the belt.

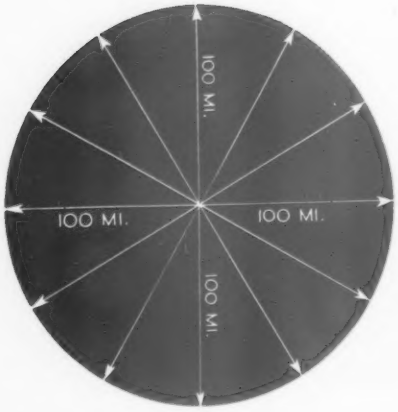


FIGURE 1
In still air, 100-m.p.h. air speed will produce same ground speed in any direction.

CIRCLE OF OPERATIONS WITH 30-M.P.H. WIND
100 MI THRU AIR
100 MI THRU AIR
135 MI OVER EARTH
112 MI. OVER EARTH
30 MPH WIND
100 MI OVER EARTH
100 MI THRU AIR
100 MI THRU AIR
82 MI. OVER EARTH
74 MI. OVER EARTH
70 MI. OVER EARTH
STARTING POINT
CIRCLE OF OPERATIONS FOR NO WIND

FIGURE 2
In 30-mile wind, the actual range of a plane over the ground is shifted in the direction of the wind and in direct ratio with its speed.

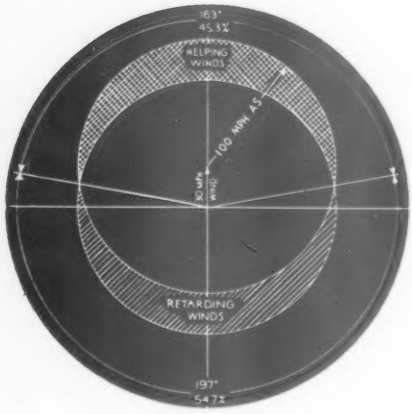


FIGURE 3
Matching the two areas shows how ratio of wind hindrance increases with its velocity.

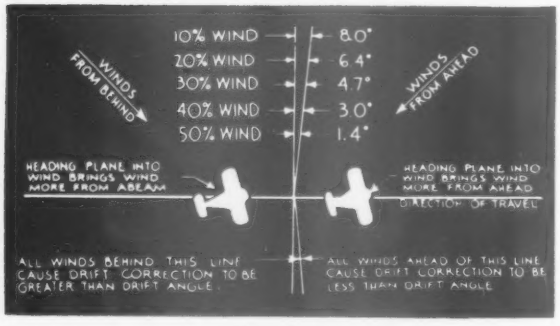

10% WIND
20% WIND
30% WIND
40% WIND
50% WIND
8.0°
6.4°
4.7°
3.0°
1.4°
WINDS FROM BEHIND
WINDS FROM AHEAD
HEADING PLANE INTO WIND BRINGS WIND MORE FROM ABEAM
HEADING PLANE INTO WIND BRINGS WIND MORE FROM AHEAD
DIRECTION OF TRAVEL
ALL WINDS BEHIND THIS LINE CAUSE DRIFT CORRECTION TO BE GREATER THAN DRIFT ANGLE
ALL WINDS AHEAD OF THIS LINE CAUSE DRIFT CORRECTION TO BE LESS THAN DRIFT ANGLE

FIGURE 4
Relationship of drift angle to drift correction. Note degree of wind variance from course of plane at which angles are same.

in this ocean will affect directly the movement of the airplane. It makes no difference whether the airplane is large or small nor what its shape may be. Each will be carried by the air currents at the same speed, just as a chip of wood and a log of wood will drift downstream at the same speed.

The drawings on page 33 show the effect of a crosswind on an airplane. The airplane placed on a moving belt, representing the wind, heads and moves in a given direction. However, at the same time that it is moving forward it is also being moved sidewise by the moving belt. This sidewise motion represents wind drift. It can readily be seen that the nature of the airplane makes no difference as to how much it is drifted sidewise. The only important item is that of its speed. An airplane that is faster and completes a trip sooner will drift less.

By heading into the wind, however, it is possible to counteract the effect of the wind as far as staying on the course is concerned. What actually happens is that the wind blows the airplane back on course as fast as it flies to the left of it. But even though the airplane is enabled to stay on course in this manner, its speed is affected by the wind and it may be faster or slower than the actual speed at which the plane is flying through the air.

On any given flight an airplane will fly one distance and direction over the ground and a different distance and direction through the air because of the motion of the air ocean. The distance through the air is based on the air speed, of course. The following three examples for a 30-m.p.h. wind and 100-m.p.h. air speed will illustrate.

An airplane having an airspeed of 100 m.p.h. in still air can, of course, go 100 miles in any direction from a given starting point in an hour's time (as illustrated in Figure 1).

When a wind is blowing, however, the range of operations changes. The center of the 100 m.p.h. circle, for instance, shifts the same amount as the velocity of the wind. The distance which the airplane can travel over the ground then depends on how much the wind favors or hinders the course of travel (see Figure 2).

This diagram also shows the effect of wind on several different courses. It will be noted that at the two points where the circles intersect the wind has a neutral effect and neither helps nor hinders from the standpoint of ground speed.

A similar diagram (Figure 3) shows the amount of helping or tailwinds and the amount of hindering or headwinds encountered on various courses. It will be noted that with a 30 per cent wind, or a 30-m.p.h. wind with a 100-m.p.h. air speed, 54.7 per cent of all possible courses will encounter headwinds while only 45.3 per cent will be favored by tail winds.

It is evident that as wind velocity increases the point of convergence of these operational cir- (*Continued on page* 105)

AIRCRAFT AUCTION

By HOWARD EARL DAY

Modernizing an old sales device put money in this airport's till.

Public sale of aircraft at this Missouri airport attracted flyers from five states. Its success led promoter to plan other such events.

AUCTIONEERS were once the middle-men of transportation. But the days of wily bidding on a surrey and a team of bays passed, and with them went the art of horse trading and the related role of the auctioneer. Or so we thought. It took Raymond Brummet, owner-operator of the Jefferson Airport at Jefferson City, Mo., to prove that the modern lightplane owner is still a horse trader at heart. What's more important, Brummet found that application of the old public-sale

Sales palaver of Auctioneer Kyger dealt in groundling inaccuracies such as "limitless speed," but it sold planes.

Pre-sale lineup at Jefferson Airport included Aeroncas, Boeing Kaydets, Fairchilds, Luscombes, Taylorcrafts. All bore airworthiness certificates.

technique to the exchange of aircraft has promoted fraternization among flyers, has effected a new turnover in aircraft sales, has publicized his airport and put money in its till.

The entire project comprises just one of the devices used by an enterprising operator whose success indicates what some practical ingenuity can do for private flying and for the men who promote it. Less than two years ago Brummet had about $100, a lease on a cow pasture, and the desire to start an airport. He had no planes, no municipal backing; he wasn't even a pilot. Despite such handicaps, the cow pasture now is a money-making airport. Secret of Brummet's success, customers say, is the brisk, friendly service he gives plus an occasional "extra" tossed in for good measure. The aircraft auction is one of those extras.

Brummet hadn't dealt with flyers long until he learned that most of those who owned planes wanted to own better ones. That spelled two sales instead of one. The only problem was to get enough buyers and sellers together to start the ball rolling. The public sale idea seemed to be a logical answer.

Publicity for Brummet's venture in aircraft barter wasn't very extensive—a few letters to plane owners in his own and in neighboring states. But the response was more than satisfactory. By sale time, 26 planes from five states were on display. The nearest thing to a mass flight was that of four planes offered for sale by Earl V. Nichols of Jackson, Mich. That 480-mile flight, incidentally, provided a bit of extra publicity for Brummet's sale, since one of the planes (an Aeronca *Defender*) was flown by two young women, Barbara Cradit and Jean Prins.

The 26 planes ranged from some pretty weather-beaten jobs to the latest of the pre-war types. Among them were Aeroncas, Boeing *Kaydets*, Fairchild *Cornells*, Luscombes, Piper *Cubs*, Taylorcrafts (more of these than any other type). All were licensed.

The sale itself blended hard-headed bargaining with old-fashioned fellowship. Auctioneers G. W. Rudy and Col. G. E. Kyger (veterans of innumerable cattle, farm and automobile sales) officiated ably, even though their knowledge of aircraft was limited. Their sales palaver describing planes having "limitless speed" and offering "silent operation and solid comfort" was hooted by flyers, but the bidding remained enthusiastic. On the whole, prices were good, though somewhat below what owners had hoped to receive. Legal transactions were completed in the airport office. Brummet's instructors checked out buyers in their new planes or, in the event purchasers were not qualified to fly, arranged for delivery of planes to their home ports. Mrs. Brummet acted as hostess for the affair, greeting visitors and arranging their entertainment and supervising business transactions.

Later, taking stock of the project's value, Brummet decided he had a good thing. That same evening he began laying plans to make the sale a regular monthly event. The plans include a few new ideas which grew out of the first sales-day experience.

Some sales had foundered on the reef of finance—not from prohibitive costs but from lack of spot cash. To offset this situation, efforts will be made to have a field representative of a local finance company on hand at future auctions to clinch sales that might otherwise be lost. A few plane owners refused to accept final bid prices, a time-wasting situation that will be changed in the future by posting minimum prices on all planes. The inability of auctioneers to make themselves heard will be solved by a public address system.

Accommodations for visiting flyers, most of whom remained over night, was another problem. For some time Brummet has kept a room reserved at a leading Jefferson City hotel for the use of any itinerant pilot who stops at his field overnight, and additional reservations had been made in preparation for the sale. But the unexpectedly large attendance led to some last-minute worries. At future auctions the participant's registration fee will be his assurance of hotel reservations and transportation to and from the field.

With these and other improvements, Brummet believes he can make his aircraft auction an increasingly profitable device. In any event, his enterprise has advertised his airport and has pleased flyers. END

aydets,
ficates.

Some owners refused to sell at auction price, but experiment was rated a success. Future sales will quote minimum prices.

Plane talk preceded each sale as pilot-owners, like this one shown with his Porterfield, mounted sales podium to answer queries about their planes.

Legal transactions were supervised by Mrs. Brummet in the airport office (above). Instructor L. Howard (below) checked out buyers in their new craft—in this case, a Fairchild PT-19.

Analyzing sale, Field Operator Brummet (above) found initial venture profitable, has others planned. Even owners who failed to sell, like those plotting homeward trek (below), like the idea.

Salvage crews could not bring whaleboats near the pitching Clipper in safety. The rubber life raft, shown under the aircraft's tail, shuttled crews back and forth between plane and boats. Men in raft often were in danger of being crushed.

Pacific Rescue

By Comdr. RALPH F. YAMBERT, USNR

PAN AMERICAN CLIPPER DOWN AT SEA AT 040935Z POSITION 2749N 14802W. PLANE IN GOOD CONDITION. IS ABLE TO COMMUNICATE ON—KCS VOICE. CALL C18601 ON—KCS. INVESTIGATE SIGHTINGS REPORT PERTINENT INFO TO ORIGINATOR.

DROWSY radio operators on ships plowing between Hawaii and the West Coast snapped to life as that message crackled in their headsets. It was Sunday, November 4, 1945.

Back of the message was the drama of a Pan American World Airway's pilot successfully landing his 25-ton flying boat in the open sea despite the fact that it was a black night and that both the plane's starboard engines were dead. Ahead lay new adventure for the *Clipper* crew and for the crew of a jeep aircraft carrier which was topping off its combat record with the unexciting work of a troop carrier.

With the broadcasting of the message, the Navy's air-sea rescue team went into action. Thirteen passengers and 10 crew members of that crippled *Clipper* didn't know it then, but hundreds of men were to spend the next 72 hours rescuing them and unsuccessfully attempting to save their airplane.

I was air officer of the *Manila Bay*, the (*Continued on page 86*)

Honolulu Clipper served seven years and logged nearly 17,000 hours before it was destroyed after forced landing on Pacific.

Under tow, Clipper's weathercocking into wind strained and later broke lines. Radar then was used to track drifting plane's position.

U.S.S. Manila Bay, a CVE, was forced to tow the Clipper since its winches and flight deck were too light to handle a 25-ton flying boat.

Crewmen climb ladder to carrier's lower deck after attaching tow lines. Rolling seas made transfers to either drifting airplane or the carrier a dangerous job.

LANDINGS IN THE SOUP

By

Lieut. (jg) MAX HODGE, USNR

Search radar antenna atop GCA trailer revolves steadily at a rate determined by operator inside. Parabolic shape of reflector helps focus concentrated radar beam.

Radar-controlled GCA landings may mean safer, more dependable year-round flying for private pilots.

YOUR calculations show that you are directly over the airfield—not that you can see it, for you are sitting on top of a fog bank whose bottom may be resting squarely on the runways. On your radio you call the airport control tower located somewhere down in the soup. They confirm what you have already surmised:

"Field closed in . . . ceiling 150 feet . . . visibility half a mile. . . ."

Fly on to the next field? You're low on fuel and this fog stretches from here to three states over. Bale out? As pleasant as warm beer. But wait! The voice from the control tower has a suggestion.

"We are turning you over to GCA," says the voice from the tower, and then a new voice comes over the earphones—a calm and reassuring voice.

But, before we find out what is said, what is GCA? The initials stand for Ground Control Approach—a new and revolutionary bad-weather landing system that bids fair to speed up commercial operations and to vastly broaden the scope of private flying.

GCA demands a minimum of equipment from the private pilot—plus a minimum amount of instrument time. The instruments needed are compass, rate-of-climb and turn-and-bank indicators, altimeter, air speed indicator, a clock and, of course, a radio. Many private pilots feel that these instruments are "musts" anyway.

Recent GCA tests with all types of planes have established the remarkable record of landing them on dual runways at the rate of one every 30 seconds—120 per hour. Contrast this with existing instrument landing procedures which, with a ceiling of 500 feet, lands planes without radar at the rate of four per hour—or one every 15 minutes.

But let's climb back into our plane above the fog bank. Let's listen to that calm voice in our earphones.

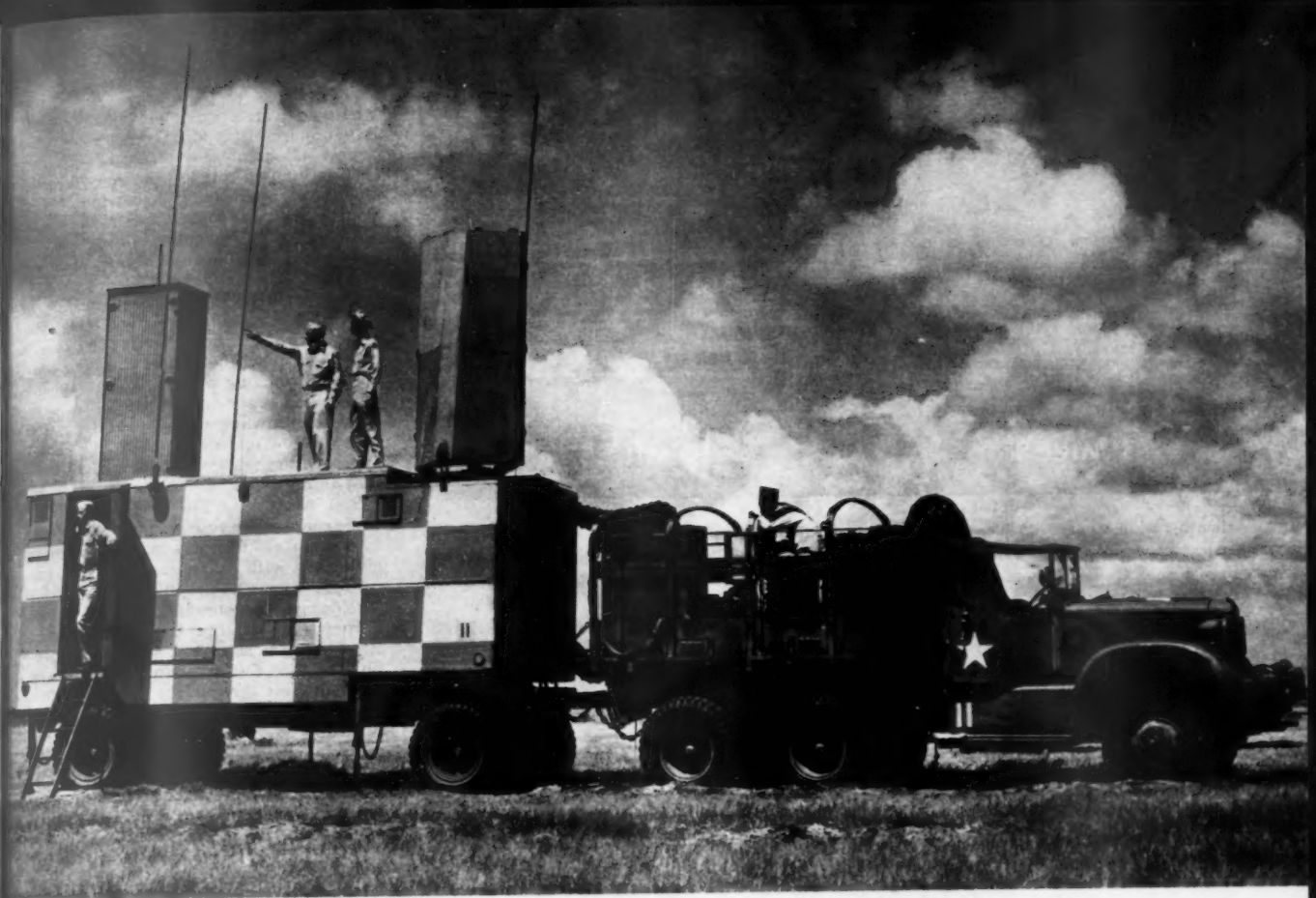
"Hello NC-172; this is National Airport GCA. What is your altitude, heading and approximate position? Over."

You answer: "This is 172. Angels 5, heading 120, somewhere over the field—I hope."

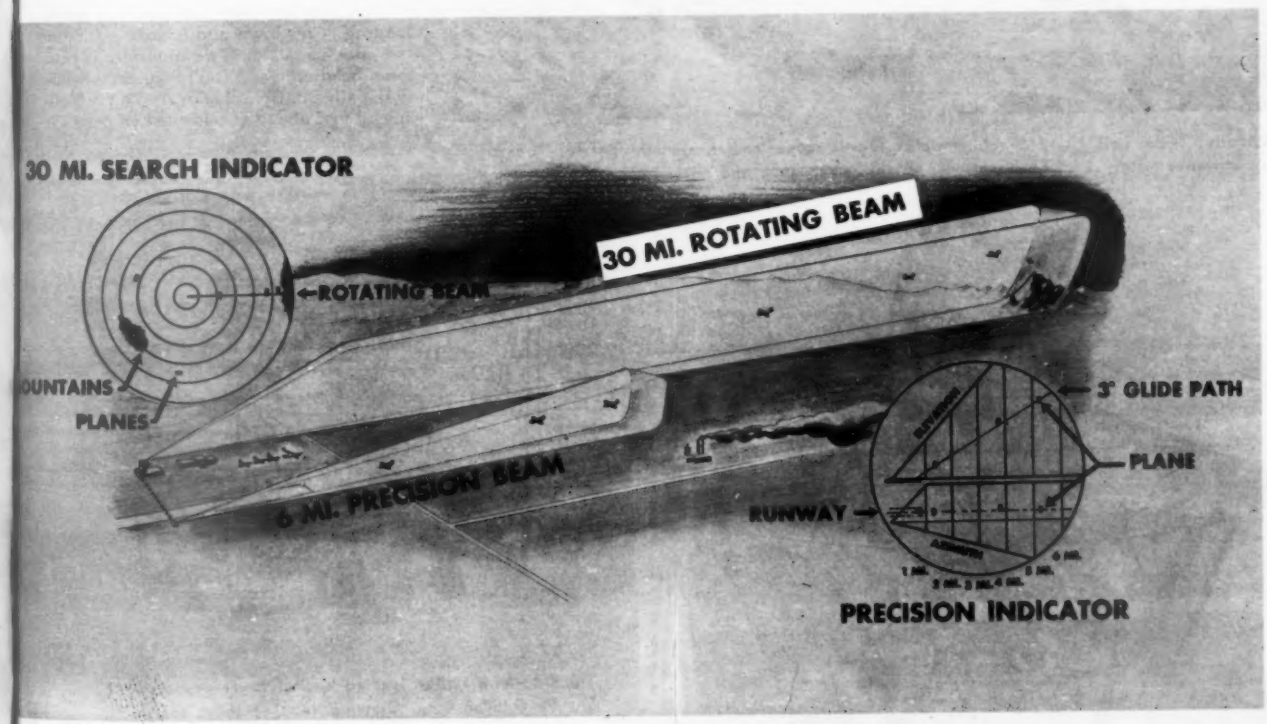
The voice comes back: "Roger, 172. We have you in sight three miles east of the field. This is your Ground Control Approach director—do you understand?"

You don't understand. What's a Ground Control Approach director? The voice, in quiet, reassuring fashion, continues over the radio.

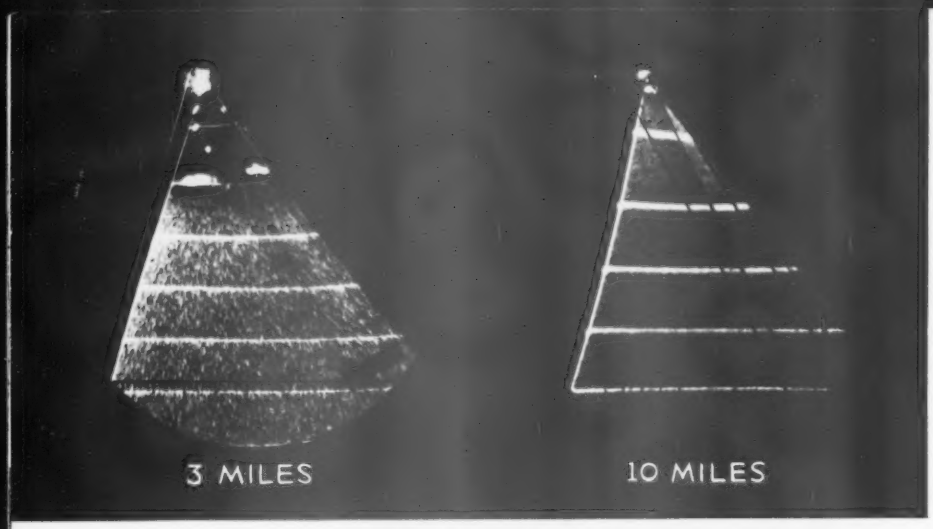
"Please follow our directions and we will bring you to the end of the runway



GCA trailer can be moved to various runways or to different airfield with minimum trouble. Army sergeant on trailer roof points to "shed" which houses elevation-determining antenna. Radar search antenna is behind the two men on the trailer.



Search and precision radar beams with indicators and scopes of Gilfillan system. The 30-mile beam rotates every two seconds. Precision indicator shows only approach sector, with elevation on upper half and azimuth on lower half of scope.



Azimuth radar scopes with plane coming in for landing. Ten-mile scale is on right, with each parallel line representing two miles. A plane approaching for a landing can be seen at the top of scope. On left is three-mile range, which enlarges top portion of the 10-mile range scope.

GCA trailer crew. Left, No. 2 director watches 30-mile scope; center, azimuth operator "cranks errors" into error meter; right, final controller watches error meter and relays instructions to pilot.

where you can touch down visually. Wh is your aircraft type? Over.

You tell him.

"Continue on course," the voice direct "You are now heading downwind. Mak your cockpit check now."

"Roger." You check.

"You are six miles east of airport. Stee right two-one-zero, over."

"Wilco. Steer right two-one-zero."

"You are on your crosswind leg, six miles from the airfield. Fly at 2,500, over."

Nothing new about this. Just the conventional landing pattern so far. Downwind, then crosswind, then:

"Your runway is 4,000 feet long, 150 feet wide. You will make a right hand approach to the runway. Steer right two-nine-zero. Over. . . ."

You guessed it. The final leg! A new voice comes over your earphones. A voice as smooth as that of a radio announcer giving out with commercials. A voice as relaxing as a Swedish massage.

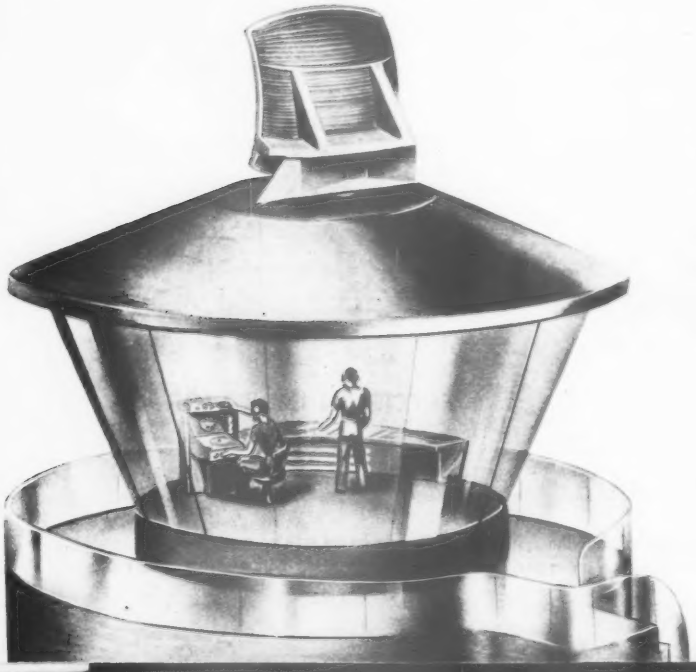
"You are on your final leg . . . do not acknowledge further transmissions . . . two-nine-zero is your heading . . . two-nine-zero . . . five miles to end of runway . . . wind on the surface northwest five . . . lose altitude 500 feet per minute . . . two-eight-five is your new heading . . ."

Not hurried. Just a steady flow of directions, easy to understand. You lose altitude at the normal 500 f.p.m., adjusting your course now and then. The voice continues, quietly, confidently.

"Four miles to runway . . . Drifting slightly above glidepath. . . . Down 50 feet . . . 40 . . . 30 . . . 20. . . . On glidepath now . . . That's correcting nicely . . . Two-eight-five is your heading . . ."

Certainly your correct nicely. You're a good pilot.

"Three miles from runway . . . check landing gear, down and locked. . . . Steer two-nine-zero. . . . Two-nine-zero is your new heading. . . . You're 20 feet below glidepath. . . . Up a shade. . . . You're holding 10 feet above (*Continued on page 78*)



One-man radar landing control tower proposed by Gilfillan Bros. Close-up (above) shows search indicator in lower panel and precision indicator above, with azimuth and elevation radar scopes.

the Month's Best

Fireball

Firebrand

Connie

Cross-Country

Harpoon

Sky-Bound

Whirligig

By FRANKLIN D. WALKER

PROMPT and systematic search for private pilots forced down over rugged or sparsely settled country is assured under a new "reporting" arrangement established by the Civil Aeronautics Administration and approved by the Non-Scheduled Flying Advisory Committee.

But the service for lightplane operators won't help the flyer who sets out over rough territory and neglects to let anyone know where he is going. Speedy formation of search groups will be possible only when pilots are wise enough to file a flight plan.

The CAA will place its communications facilities at the disposal of any private pilot who chooses to file with any communications station a plan of the flight he proposes to make. Contact flight plans will be accepted, the key item in the plan being the estimated time of arrival.

If a pilot who has filed a flight plan fails to arrive at his destination within two hours after his ETA, the CAA communications system will swing into action and begin checking the plane's movements. Actual search, if it becomes necessary, will begin not later than four hours after the ETA and it will include local CAA pilots, members of organized flying organizations, volunteer pilots, the Coast Guard and the Army Air Forces search and emergency rescue branch.

Under consideration is a proposal to penalize a pilot for neglecting to close his flight after he reaches his destination. The penalty would be a fine for failure to report in. The size of the fine has not been determined but members of the CAA administrator's staff have suggested a minimum of $25 and a maximum of $100. Reason for the fine is that in the past CAA pilots have spent much time and money searching for a pilot who subsequently was found sleeping peacefully in a comfortable hotel bed.

The CAA has declined to return to the practice of transmitting all flight plans submitted by private flyers, but has agreed to make its communications system available to those who will file and adhere to a flight plan. If the burden of this type of plan becomes too heavy, private pilots who want their whereabouts known when flying contact probably can make an arrangement with commercial telegraph lines.

The decision to work out a search system was motivated by three letters to CAA. One was from the Seattle unit of AOPA which recommended complete reinstatement of CFR flight plans. Another was from a western newspaper reporter who was disturbed by the fact that search for a private plane which crashed near his community did not begin until four days after the accident occurred. The reporter admitted, of course, that the pilot of that plane had not filed a flight plan. The third letter was from Joseph S. Bergin, Director of Aeronautics for Utah, who urged acceptance by CAA of all civilian contact flight plans.

The Advisory Committee also recommended extension of the airmarking program with most of the responsibility resting with the states. The committee turned down a proposal that fines be imposed on pilots convicted of reckless flying on the ground that suspension of licenses in such cases is adequate punishment.

Surplus Commandos

Although many airlines need twin-engined, short-haul transports, none appears interested in 447 surplus *Commandos* (C-46s) on the Reconstruction Finance Corporation's list. Eleven have been sold, nine going to Col. S. C. Dunlop of Gainesville, Ga., who plans a non-scheduled operation for southwest oil companies; and two going to Dr. S. G. Mudd of Los Angeles for use in connection with South American mining activities. The RFC price tag on each of the *Commandos* sold to date was $27,500. Most curious angle of the sale was the report by the RFC public relations office that the *Commandos* "are eligible for certification for cargo use." Type certification tests on the *Commando* are being conducted in San Antonio, with representatives of Colonel Dunlop's company working with CAA engineers. Results of the tests, which will decide whether the plane will be available for air carrier passenger or cargo duty, probably will not be announced for 60 days.

Avoid Those Wires

A CAB Safety Bureau study of wire collisions involving airplanes in 1943 reports that slightly more than 50 per cent of all collisions with obstructions while in flight were traced to the wire menace. Only 35 of 122 wire collisions occurred on airports, while 87 wire collisions took place elsewhere. Removal of wires from airports would have eliminated only about 25 per cent of wire collision accidents.

"From these data," the study reports, "it appears that the answer to the real problem is to be found in some method of developing a greater degree of alertness on the part of the pilot. The need for keener observing ability and habits of visual alertness will increase as air traffic becomes more congested. The Safety Bureau therefore finds it difficult in the face of statistical records to believe that removal of wires is the final solution to the problem.

"This does not mean that the Safety Bureau believes there is a virtue in allowing wires to remain around airports merely for the purpose of teaching pilots to be observing. The Bureau also would like to see all wires surrounding airports buried. The major problem appears to be one of developing habits of greater visual alertness in order that trees, houses, towers, mountains, and other aircraft may also be avoided."

The Safety Bureau study offers these suggestions to flyers who would avoid wire collisions:

Scan closely for wires and poles whenever approaching the ground. Poles can be seen for a greater distance than wires; however, many times poles are hidden among trees.

Continue to scan for wires through the entire approach. Some wires cannot be seen a great distance.

Maintain an ample margin of clearance when approaching over wires to allow for variable lift conditions.

Execute simulated forced landings only to a safe minimum altitude of 200 feet.

Remember that too rapid and too much back-stick control means a stall and mush in spite of the use of full throttle.

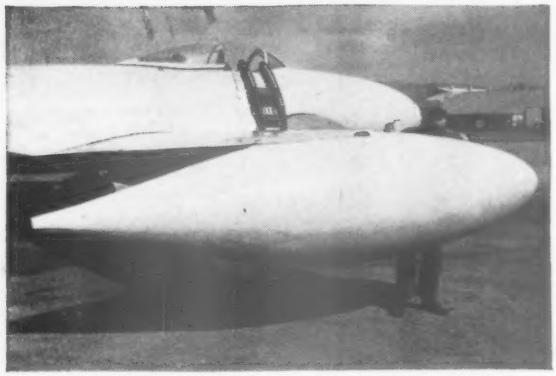
Understand that such factors as attitude, weight loading, load factors imposed by rate of pull-up, altitude, and airspeed are a part of the stall phenomena.

Know the relationship between the stall factors and the problem of trying to "horse" the airplane over wires.

Fly the plane over the wires; do not stall it over.

When making an emergency take-off,

(*Continued on page* 119)



Wing-tip tanks, specially built to hold 300 gallons each, gave Shooting Star cross-country range for non-stop flight.

THAT P-80 FLIGHT

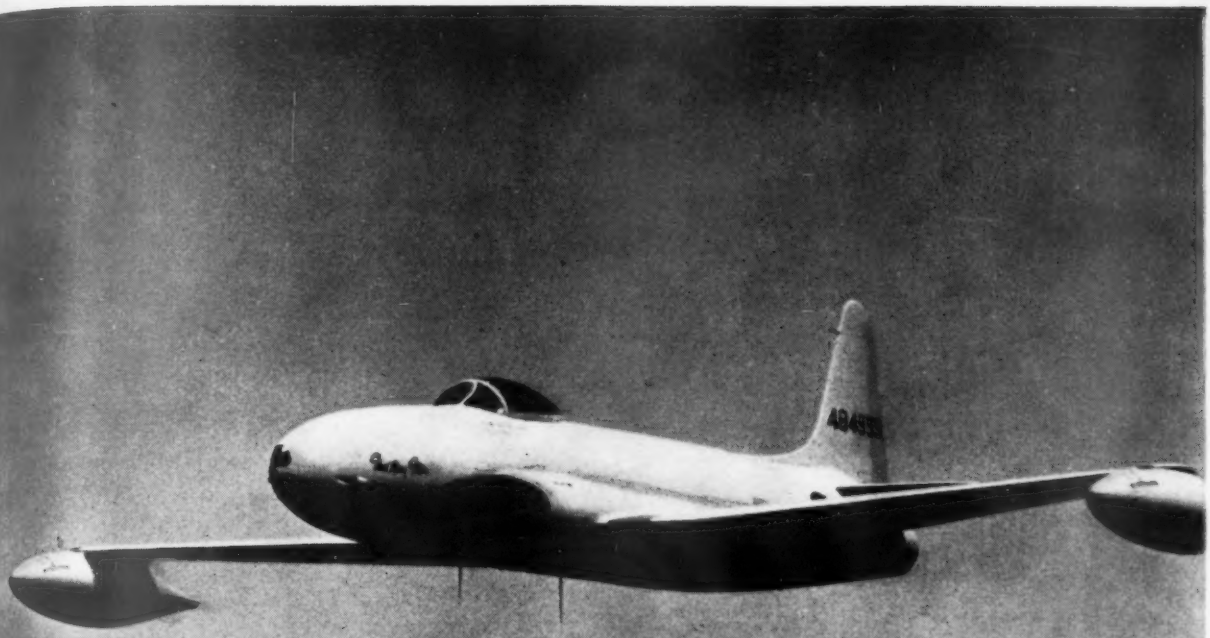
Three record-smashing pilots, carrying flight gear, pose prior to climbing into their planes. Left to right are Col. William H. Councill, Capt. John S. Babel and Capt. Martin L. Smith. They landed in that order at LaGuardia Field.

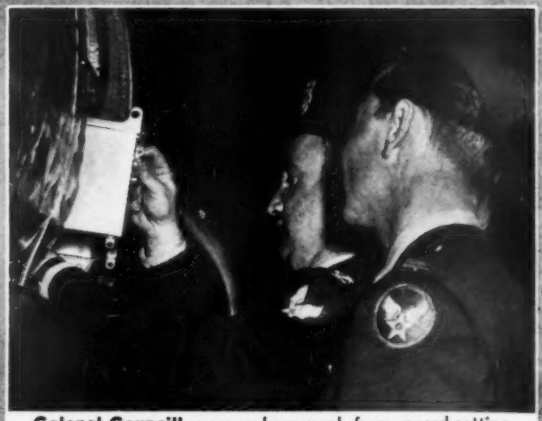
FLYING the amazingly high average speed of 584.82 m.p.h., Col. William H. Councill smashed all transcontinental speed records January 26 in a Lockheed *Shooting Star*. Colonel Councill and two other Army pilots took off in three P-80s from Long Beach, Calif. All three broke the then-existing cross-country record, but Councill's plane was the fastest to La Guardia Field—4 hr. 13 min. 26 sec.

Councill's companions, Capt. John S. Babel and Capt. Martin L. Smith, made four-minute and six-minute refueling stops respectively at Topeka, Kan. Their respective times were 4 hr. 23 min. 54 sec. and 4 hr. 34 min. 25 sec.

Special 100-gallon fuel tanks were installed in the P-80's noses, and radio compasses were added as extra equipment. Colonel Councill's plane had two 300-gallon wing-tip tanks while the other two planes had 150-gallon wing-tip tanks. The non-stop plane carried 1,165 gallons of kerosene in all. Ground speed of the craft in some stretches exceeded 700 m.p.h., hinting at world record speeds, though the planes had tail winds. Here is FLYING's interpretation of Councill's log, written on his metal knee pad.

Place	Mileage	Elapsed time from take-off	Average speed for each leg
La Junta, Colo.....	870	1 hr. 38 min.	532.80 m.p.h.
Garden City, Kans..	1020	1 hr. 55 min.	529.20 m.p.h.
Salina, Kans.	1190	2 hr. 09 min.	728.40 m.p.h.
St. Joseph, Mo.	1350	2 hr. 28 min.	505.20 m.p.h.
Kirksville, Mo.	1475	2 hr. 38½ min.	714.00 m.p.h.
Chanute Field, Ill...	1700	3 hr. 02 min.	574.80 m.p.h.
Akron, O.	2050	3 hr. 34 min.	656.40 m.p.h.
LaGuardia Field, N.Y.	2470	4 hr. 13 min. 26 sec.	637.80 m.p.h.





Colonel Councill removes barograph from record-setting P-80. The sealed device officially recorded flying time.

Shooting Star is pushed into hangar after setting new coast-to-coast record. Time was 4 hr. 13 min. 26 sec.

Stupe getting first glimpse of pearly gates. This is the booklet's front cover.

PILOT ERROR SENSE

Special bone-head ratings created by Navy flight instructors for cadets also apply to private pilots.

Your Wings make you eligible for goof ratings.

PROBABLY you have found out already that wings are very helpful to you and your flying career. But unless you watch yourself, your wings can help you to make less agreeable things, mistakes, for instance. In fact, there are so many dumb mistakes you can make that they have been classified as to type, and various ratings have been established for them.

To make one or more of these ratings, only three things are necessary:

(a) Cockiness
(b) Carelessness
(c) Judgment (poor)

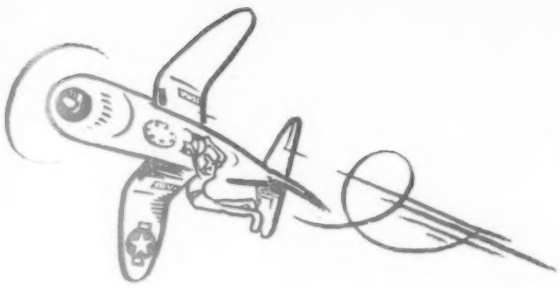
Before striking for one of the rates, analyze yourself. Make sure you are ready for the exam. Then ask yourself these questions:

1. "Am I cocky enough?"

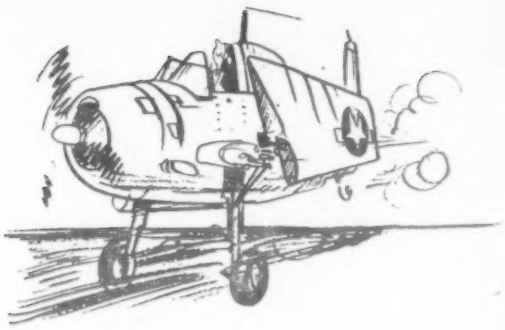
Can you truthfully say to yourself that now, when you have learned to take off and land an airplane, you have enough

Flying presents another condensation of the U. S. Navy's Sense Manuals. This manual, "Pilot Error Sense", although written for the Naval cadet, discusses many problems applying to private flyers — who, incidentally, have one of the highest accident ratings of any airplane operating group.

Goon: ignores check-off list.



Aerobatty: forgets his safety belt.



Zaney: misses no major mistakes.

overconfidence to go out and crack it up in a truly spectacular manner? Could you put it into a slow roll with your safety belt unbuckled, holding on to the seat with one hand to keep from falling out? That's been done, mind you, but are you that cocky?

2. "Have I achieved maximum carelessness?"

This doesn't mean leaving your wallet in your other suit when you're going out on a foursome with a pal whom you know has enough dough to catch the check. It means something really outstanding—like trying to take off in an *Avenger* with the wings folded. You think that's too much to expect? O.K., it happened. And it wasn't a student who set this remarkable record, it was an aviator with wings!

3. "Can I count on my judgment to make me do the right thing at the wrong time and vice-versa?"

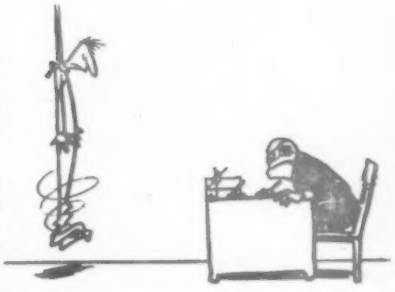
It's hard to exercise bad judgment in an airplane. It wants to take off; you have to restrain it from taking off too soon. It wants to land; you have to keep it in the air when you're landing. But you can misguide it, all right, if you apply yourself. For example, if you have an engine failure just after take-off, the plane will try to land straight ahead, which will cause the least possible damage. But if you try to make it execute a 180° turn to get back to the field, the plane will show proper resentment and you will wind up with a face full of instruments.

Well, if you can answer these three questions in the affirmative, you are ready to strike for a rate. But don't get grabby. Try for one at a time while you're learning, and then step out and try for two or more at a time. It is not too much to hope for to rate Goon 1/c at the same time you make Squashhead 2/c —if you play your cards right. You might even strike for Heel 3/c on the same flight when you qualify as Chief Stinker. Deeds like this have been performed.

The outstanding record in the service to date is held by Ens. Thaddeus P. Hefflethong of Waukegan, who, shortly after leaving his carrier, staggered his shipmates in the fleet by achieving simultaneously a first class rating as Goon, Dope, Klunk and Zaney.

This, however, is a record you can hardly hope to duplicate. Ensign Hefflethong's portrait hangs in the municipal auditorium in Waukegan. Ensign Hefflethong hangs, it is reputed, in the anteroom of the CO.

Let us examine the various rates and



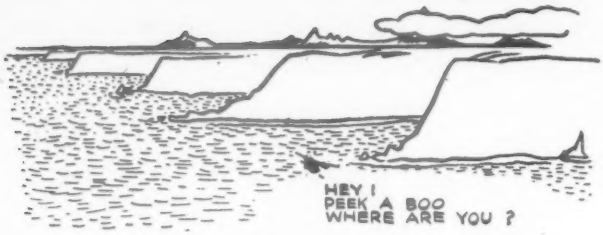
Hefflethong gets highest rating of all.

Straggler: everybody's target.

Heel: blasts microphone.

Klunk: cages only his head.

Chief straggler: in plane modified by enemy.



Dope: can lose himself in 17 seconds.

the qualifications for them. Don't let the high standard of requirements appall you. You can meet them—they are being met all too frequently.

The first of the rates, and the easiest to make, is Dope. You make that by getting yourself lost. One of the best ways to qualify for it is to catch up on your sleep during (navigation) courses. There is something about a Mark Three plotting board that makes you want to lay your head right on it and wander off into dreams. That is a good way to make Dope.

You qualify as Dope 3/c if you can't find your way to the hangar. To make Dope 2/c, you have to be unable to find your way back to the airport. If you can't find any airport, you make Dope 1/c. But to make Chief, you have to get lost from your carrier. This is really the easiest rate to make but it has this disadvantage—it is very difficult to draw your specialty mark from ship's service which, of course, is located on the same carrier that you haven't been able to find. Your shipmates, however, will inform your next of kin that the last thing you did was to make Chief Dope.

Another easy rate to make is Straggler. You qualify by simply getting out of formation. This rating is available to almost any type of pilot. It is rather difficult to make in the ferry command, but otherwise it is a cinch.

If you merely lag behind the formation and louse up its appearance, the best you can hope for is Straggler 3/c. But if you apply yourself assiduously, you may be able to conduct yourself so that you upset the entire section, scattering it around the sky with gay abandon. This rates you as Straggler 2/c. If you can get more than one formation Fubar (Fouled Up Beyond All Recognition) you make Straggler 1/c.

But the crowning glory (during the war—Ed.) was making Chief Straggler. This could only be accomplished in a combat zone and you made it by dawdling along behind the formation until a couple of *Oscars* came along and nibbled away your wing surfaces with 7.7-mm. machine guns. This rate, unfortunately, was conferred only posthumously.

Speaking of combat operations, the rate of Sucker was available only when in the proximity of the enemy. You made this rate, like Straggler, by getting out of formation, but the Sucker had a different frame of mind from the Straggler. The latter wandered off because his mind was wandering. The former left the formation because he wanted to become a hero and couldn't stand for some other fellow to share the glory.

There is another rate you can make during formation flying which is even more desirable—Squashhead. This specialty mark usually is earned during the process of joining up, and it gets the eyes of one and all upon you—you and the unwilling partner who inadvertently assists you in making the rate.

You make Squashhead 3/c by bustling into the formation and cutting across in front of the section leader. This brings you to his notice in a most effective way. If you have been annoyed by his seeming lack of attention to you in the past, he will more than make up for it now—and later, when he gets you on the ground.

Getting out of position in the formation and elbowing other planes around while correcting yourself is a good way to make Squashhead 2/c. If you come barreling into the formation, bank sharply and smack into the plane in your blind spot, you have become a Squashhead 1/c. You also make it by boiling in from astern and getting sucked into the slip-stream. Nobody has made Chief Squashhead yet. To do that, you have to knock the whole formation out of the air, which is hard to do, because the cowards employ evasive tactics.

The foregoing rates are rather conspicuous and in case you are the shy, retiring type who shuns the spotlight of publicity perhaps some of the more modest rates will appeal to you. Don't think for a minute that the specialty marks are restricted to the bombastic, swashbuckling young aviators. Not at all. By spending only 15 minutes a day you, too, can join the swelling ranks of rated dunderheads.

For instance, if you don't want to go in for the more spectacular specialties, why not strike for Klunk? All you need is a little self-confidence and an airplane instrument panel.

A good way to make Klunk is to forget to set your altimeter. If the instrument reads 50 and your altitude is minus three, you make Chief without further examination, which is fortunate, because you won't look well when examined.

A young *Catalina* pilot at the Jacksonville Naval Air Station, recently made Klunk 1/c by a quick and most efficacious method while practicing water landings. With his eye riveted on the artificial horizon, he landed on his first attempt with his starboard float about one fathom under the water. His instructor thereupon reasoned with him in terms which drew an exception from the chaplain at Cecil Field, some 16 miles away. The pilot tried again and managed to get the port wing tip in the water. This time, the women's clubs of St. Augustine, Daytona Beach, Lake City and Gainesville called up the station to complain about the instructor's language.

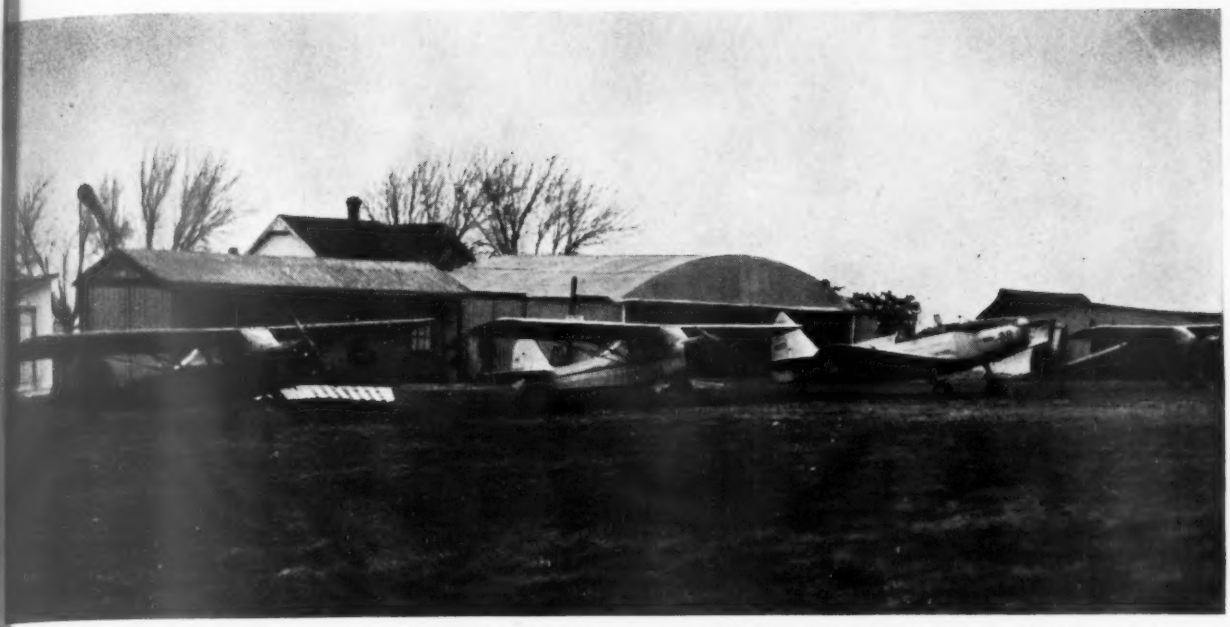
"I don't understand it, sir," the pilot wailed to the instructor. "I had my eye right on the artificial horizon. And it was just as level as . . . as the horizon."

"Lemme see it," said the instructor.

(*Continued on page* 94)

Corpse 1/c: achieves final rating.

CARS TO CUBS



Garage service methods have made this airport at Warrensburg, Mo., a profitable operation, though town has only 6,000 population.

Using service methods he learned in the automobile business, H. F. Jones has made his airport investment pay out in two years.

By REESE WADE

FOUR years ago H. F. Jones was selling Fords in Warrensburg, Mo.—population 6,000. As service manager of a garage he learned that *service* sold automobiles.

But there was a war on and there were more important things for a 42-year-old man to do than selling automobiles. Jones became a military instructor and for the next 18 months thought of nothing except airplanes and the pilots who flew them. When the need for instructors dropped, Jones returned to Warrensburg still thinking about airplanes and pilots. He decided to forsake the automobile business and take over the local airport as operator and manager.

Jones had known airports and operators as a private flyer and hadn't liked what he saw. He decided that airplanes and automobiles are much alike and that service would sell aviation. Going on that basis, his airport is as unlike some fixed base operations as he can possibly make it.

"The days are over when an operator can milk the aviation business for profit," he says. "If we merely take all we can get out of aviation and put nothing back in we will never have an aviation business anywhere comparable to the automobile business.

"For instance, when I was in the automobile business we established definite rules which gave the customer better service. When I entered commercial aviation it never occurred to me that an airport was operated any differently than a good garage is operated but, brother, I was mistaken."

He gestured through the window of his office asking, "Do you see any loose paper flying around . . . Any litter of empty cigaret packages? Not here. Of course our customers throw papers around but we pick them up. We aren't going to offend customers used to clean garages with a filthy airport. This area has to be 'policed' and so do the airport employees."

Inside the hangars he points to the mechanics rebuilding an airplane and tells of his airport floor rule. "Every repair job on the field must be completely cleaned up at the end of each day before the men leave. All tools must be picked up and put in their places and all unused parts placed in storage bins. That's a practice I borrowed from the automobile business."

A visiting airplane drifts in for a landing. "Here's something else that I brought from the automobile business," Jones points out. "When that plane lands, someone will be there to meet it. Someone must be there to ask the pilot what he wants, to tell him where we want to park his airplane and to offer him whatever help we can supply. His windshield will be washed and polished without his requesting it and his tires will be pumped up if they need it. So far, I've never been offered any windshield cleaning service at airports where I have stopped but no plane will come in here without getting it.

"If the mechanic gets into that plane he will put a clean cloth on the seat. Our men are forbidden to sit in an airplane in dirty clothes. It's standard garage practice, but how often do you find it in aviation?

"Some operators will think it's silly to meet each visiting plane," Jones went on. "But let me tell you about a trip I took not very long ago:

"I flew into an airport for gasoline. It wasn't a little airport. Twenty or 30 planes were on the field. I landed, parked on the line, and waited. No one came out, so I walked to the hangar. I asked the first man I saw where I could get some gasoline. 'I don't know,' he said.

"I asked where I could find the boss,

and was directed to his office. When I found him, I said:

"I'd like to get some gasoline."

"He snorted, 'I can't get the gasoline out to your plane. Why didn't you bring it up to pump?'

"I didn't know where the pump was. No one could tell me."

"He snorted again, 'How do you expect to get gas away out there. If you want gas, bring your plane over here.'

"So I walked back to my plane. A mechanic came over and volunteered to help me start the engine. As he turned the propeller, an instructor came over. 'What are you doing?' he snapped. The mechanic said he was just helping me start my plane. 'Hell!' shouted the instructor. 'Let him start his own plane.'

"So I started my plane, got just enough gasoline to reach the next airport, and stopped there for 42 gallons. I'll avoid that first airport from now on. And Mister—this airport is going to be different!"

Visiting pilots tell Jones that approximately 90 per cent of the smaller airports allow the visiting pilot to wander around until he finally locates the service he needs. They say it is a pleasure to be met, cheerfully greeted, expertly serviced and sped swiftly on their way. One visitor flew more than 100 miles out of his route merely to land at Jones' Warrensburg Airport, buy about 10 gallons of gas and a candy bar, chat a few minutes and take off again.

The service charges made by Jones are comparable to other good fixed-base charges, he believes. His A and E service is $2. Tie-down service is 50 cents a night and Jones' employees do the tying-down. Soon he plans to have a courtesy car for visitors. It's far enough into town that he expects to make a small charge but it will be about half the regular taxi fare.

On May 5, 1944, Jones took a five year lease on his 80-acre field. He bought a *Cub Coupe* from Stephens College in Columbia, Mo., and went in business with four students.

Today he has six planes on his flying line, 35 students, a repair shop equipped to handle major overhaul and recovering jobs and three A & E mechanics available to see that it is done right.

The three mechanics supervise 11 helpers. In all, 17 persons work on the field, including a full-time permanent office employee.

Jones' students fly in two Porterfields, two Taylorcrafts, a Fairchild *Cornell* and the original *Cub*. All but the *Cub* were acquired from the Defense Plant Corporation. By May 5, 1946—two years from the date of starting—Jones estimates his $15,000 investment will have paid for itself.

One "T" hangar is used for the shop. Two metal hangars house Jones' airplanes and his three permanent renters. He plans to build a group of individual hangars for private owners, plus a large hangar designed to house "one of the most modern shops in the country." By this summer he plans to have a five-place plane for charter trips.

South of the hangars, facing the flying line, is the airport office. Here business is transacted, cold drinks and candy bars are sold, and students await air time. Automobiles are parked immediately adjacent to the office building. Jones maintains strict safety rules on the airport and parking must be in restricted areas.

Jones' airport is located nine miles southwest of Warrensburg and is reached by a concrete highway and a gravel road. It is on high ground with clear approaches to the three turf runways. Runways are 2,200 feet SE-NW, 2,100 feet N-S and 2,100 feet NE-SW. Each runway is mowed every 30 days.

Largely through his efforts the local college is now offering solo, private and commercial flight courses for credit. Rates are $7 an hour solo or dual.

Until recently, Jones handled all instruction himself. Now, however, he has added one permanent full-time instructor and another part-time instructor who will become full-time soon. Both new instructors are women and were trained by Jones. Mrs. Hildred Toogood, wife of an Army pilot, is sharing the full instructional load with Jones. Both women are in the air from two to eight hours each day.

Jones isn't too optimistic about the current crop of lightplanes. The airplane for the private individual isn't on the airport yet, he says. "The little ships with simplified controls and non-stall and non-spin characteristics are good little airplanes, but the private owner will want something more. Maybe he'll want an amphibian so he can land on water or land. Sportsmen, I'm sure, will want that."

Speaking as a garageman, Jones is irritated by aviation's prices and costs. "Anything with the word 'airplane' on it costs more than it should. Insurance is out of sight. If you buy a blow torch for an airplane, you pay more than you'd have to pay for any other blow torch. And service costs are high, too.

"When I was in the garage business, a good car mechanic earned about $35 a week in a town of this size. An A & E mechanic earns from $45 to $50 and the extra cost is passed on to the owner of the airplane. Add the extras up and it amounts to more than most people can afford."

For his future staff, Jones wants only trained sales people. "Not just pilots or instructors, but real salesmen. Naturally, they also will be able to fly and instruct, but chiefly they will sell. They are the ones who will build aviation."

Meanwhile, Jones will continue to be a fixed-base operator who believes these rules are vital to aviation's future growth:

1. Neatness of field, airplanes and personnel.

2. Immediate and friendly service for every visiting pilot, including free windshield wiping, tire inflation and directions.

3. A business-like approach to making students want to fly well so they will become aircraft owners and boost aviation to their friends.

It all sums up in the fixed-base operator selling himself and his wares through exactly the same sort of service as his brother in the garage business. END

H. F. Jones checks reports with office manager, Mrs. F. L. Hayden. Jones learned service in the automobile business, has found it works even better on a fixed-base operation.

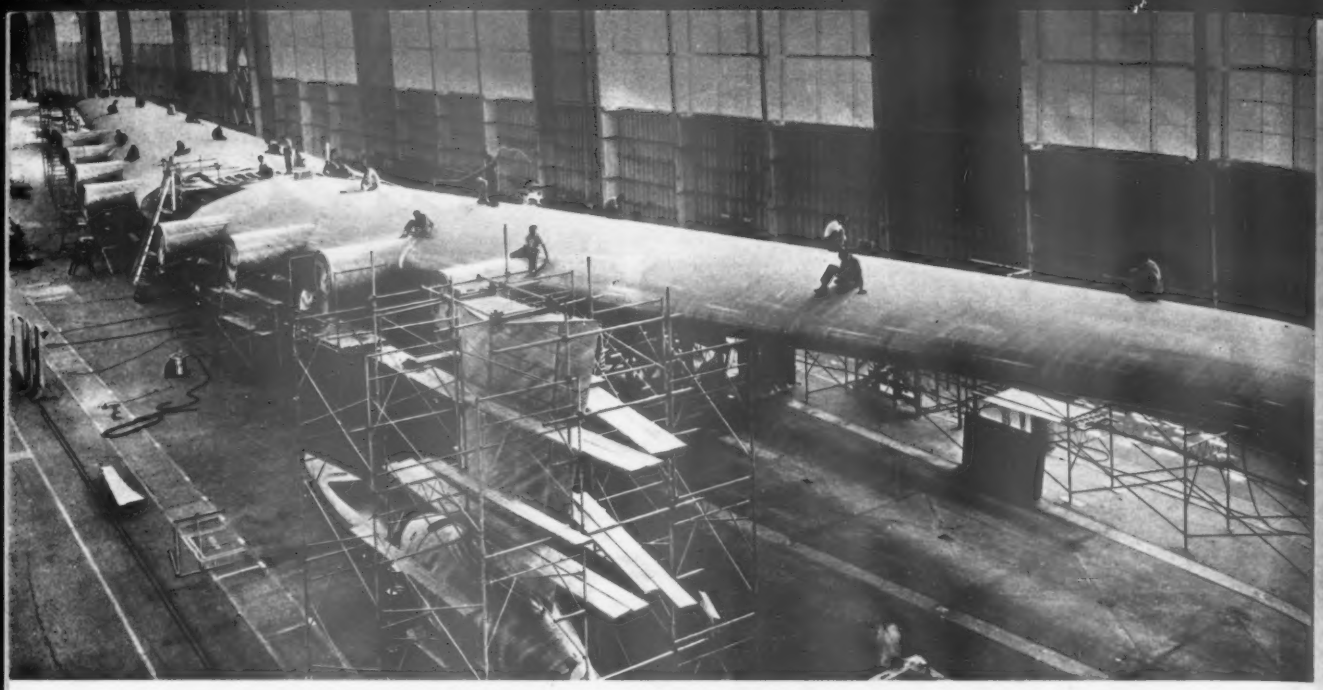
Wooden Wonder

Dwarfing the B-29 beside it, the H-4 has a 320-foot wing and its hull is 220 feet long. Fuel load is 14,000 gallons.

It cost a huge fortune to build the fabulous Hughes H-4. And it will cost another just to move it from the factory down to the water.

THE world's largest airplane is designated, with disarming simplicity, the H-4. But that's a tag that conveys little meaning to a public accustomed to the use of flashy names for all airplanes, even those puddle-jumpers that would come out second in a race with a fast horse.

Of course there is an unofficial (and very colorful) name for the 400,000-pound flying boat built by Howard Hughes at Culver City, California. It is applied involuntarily by most visitors who see the vast bulk of the unfinished aircraft for the first time. It consists of two words, uttered in a dazed tone and without deliberate irreverence, that express more of the impact of the collosal undertaking than this entire article can hope to present. Unfortunately, because of the modicum of modesty which is re-



Gigantic wing and its wing-tip floats (one in foreground) are plywood. Only metal in plane structure is forward of the fin walls in each engine nacelle. Eight engines of H-4 will develop total of 24,000 h.p. Diameter of four-bladed props is 17 feet.

Hull interior, looking aft from halfway station, looks like a huge tunnel. Distance from camera to tail is about 100 feet. Gross weight of the H-4 will be over 200 tons.

Flight deck alone is larger than many present-day airliner interiors. View shows pilots' seats in distance and navigation, radio and engineering stations in foreground.

quired of the public press, you will probably never read those words—certainly not in these pages. We'll simply dub the H-4 the "Wooden Wonder."

Everything about the H-4 is out of proportion with the conventional. Even the building of it was inspired by a man who never built an airplane, a man who knew less about aircraft design than the Wright brothers knew when they constructed their first model of wood and muslin.

The man was Henry Kaiser, west coast highway, dam and bridge builder who, during the war, stepped into an amazing variety of industries ranging from shell and steel making to shipbuilding. Supremely confident that he could carry off any job the Government would finance, Kaiser proposed in the spring of 1942 that he be commissioned to build a fleet of enormous airplanes to carry American war materials around the world. Those were the days when German submarines were torpedoing our ships on the Atlantic in almost unchecked fashion and frequently within sight of the coast.

In that extremity, Kaiser's suggestion seemed attractive. He introduced it with appropriate ballyhoo. And while a gasp went up from an aviation industry aware of the proportions of the task, the great majority of Americans appeared to be dazzled, hopeful, and happy.

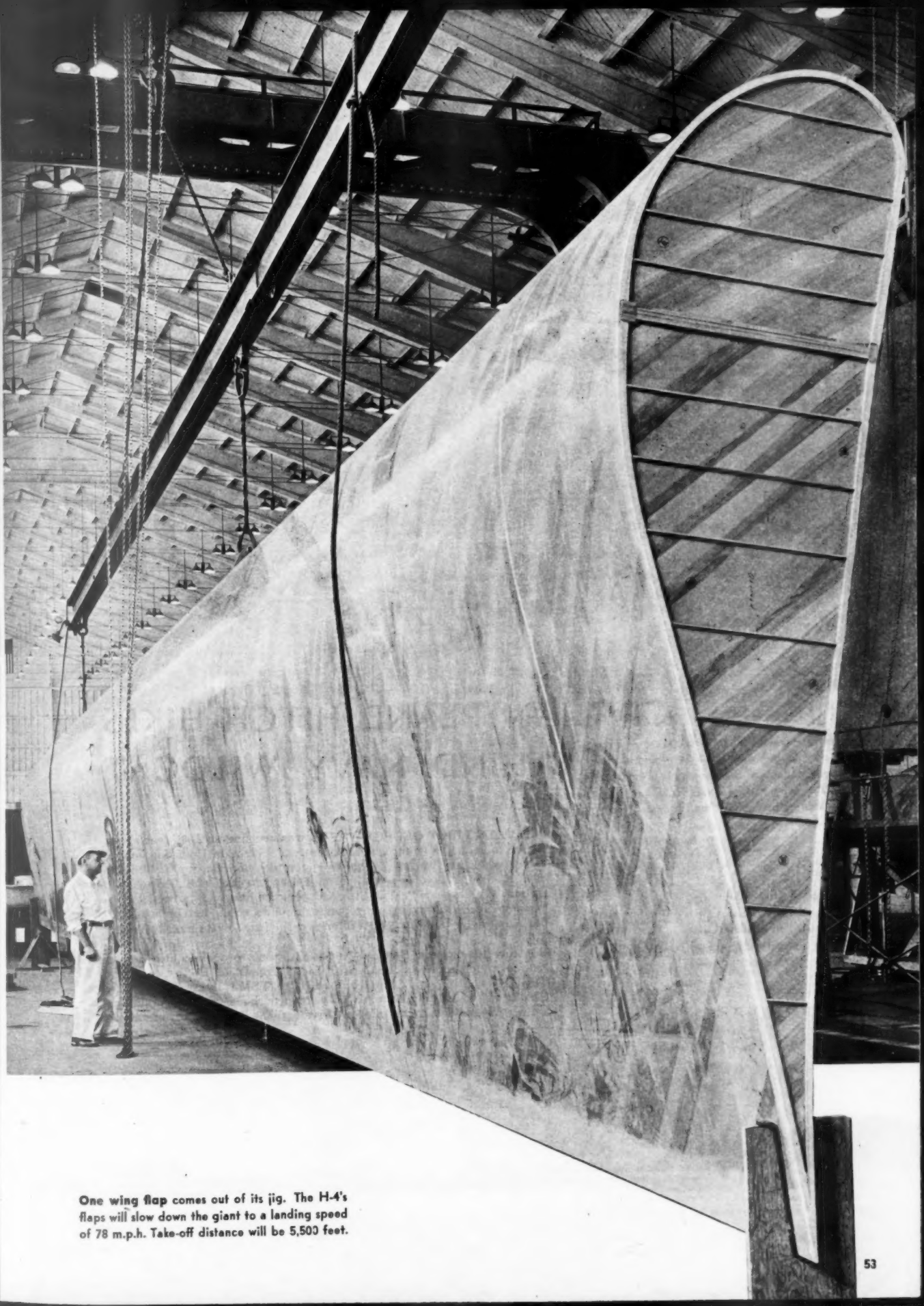
Kaiser did not wait long at official doors for a hearing. The air of political influence he wore (the result of several visits to the White House) and his well known genius for conducting vast building operations on Federal funds did the trick. He attended conferences over a period of months in mid-1942 with admirals, generals, and War Production Board officials.

Aircraft industry then was going through the most critical phase of its chronically precarious existence. It was a small industry, producing a highly complicated machine, and doing it largely by hand. Now quite suddenly, this industry was asked to expand a hundred-fold, to make a better product and make it faster—and all this despite critical shortages of essential materials and a painful lack of experienced technicians.

Forecasting their needs several years in advance, the Army and Navy had allocated (through a complicated priorities system) every ounce of aluminum, every engine, and all the myriad airplane parts the country could be expected to produce. These were allotted to established aircraft producers on the basis of the contracts they held. Both branches of the service had projected campaigns not only on the number of planes the industry was to produce, but upon the available types the Army and Navy considered most suitable for their needs.

Further, the industry was attempting a radical innovation: an approximation of the moving production line typical of automobile manufacturing—a process that, once started, was costly to stop. Embarked on such a program, it was natural that the plane makers received Kaiser's proposal with the same warmth a doting father would extend to a two-headed suitor for the hand of his favorite daughter.

Nor were the Army, Navy and WPB officials any (*Continued on page* 82)



One wing flap comes out of its jig. The H-4's flaps will slow down the giant to a landing speed of 78 m.p.h. Take-off distance will be 5,500 feet.

SKY TOW

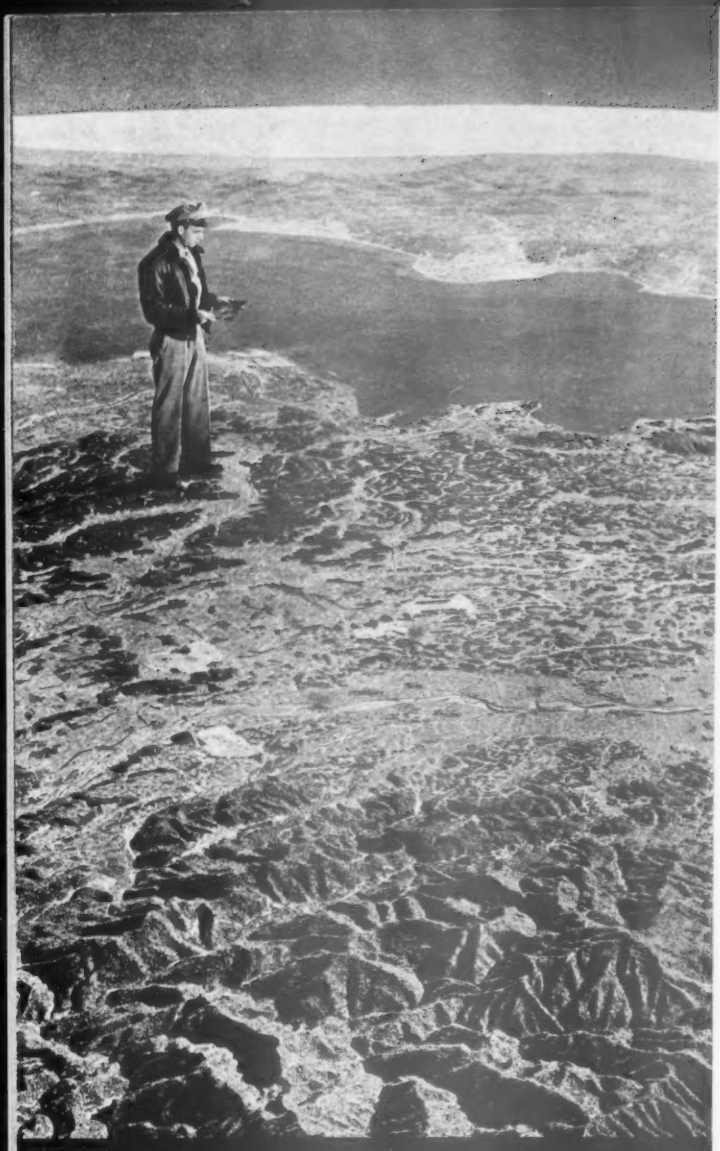
CIVILIAN PLANE HITCH-HIKES BEHIND NAVY WILDCAT

PRIVATE PILOT GEORGE YAFFE was cruising at 2,000 feet about five miles north of the Naval Aircraft Modification Unit, Johnsville, Pa., when his Stinson *Voyager's* engine developed a knock and the oil pressure gauge dropped to zero. He had to land at the Naval air station. A check revealed the *Voyager's* engine had burned out a bearing, necessitating major repairs. Repairs could not be made at the Navy field, but Navy men offered a *Wildcat* tow to nearby Wings Field.

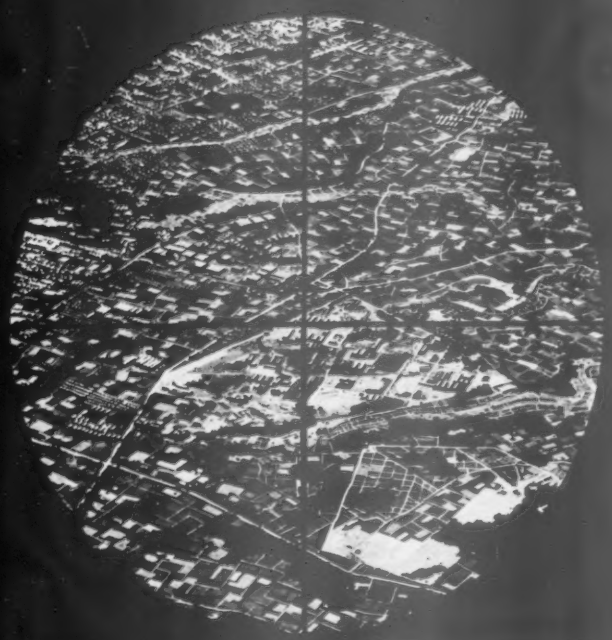
A tow fitting was clamped to the Stinson's propeller hub and a 250-foot nylon rope attached. With Lieut. Comdr. M. B. Taylor at the *Voyager's* controls and Lieut. Richard Ryan, USMC, flying the *Wildcat*, the "train" averaged 120 m.p.h. The trip perhaps presages a similar aerial tow service to be offered private pilots by civilian operators.

Voyager, having lighter wing loading, became airborne first, then leveled off to allow towing Wildcat to make its take-off.

Wildcat had towing attachment replacing arresting gear hook, flew tail-down from drag of Voyager. Nylon tow line (below) was hooked to a tow-fitting clamped to Stinson's propeller hub. Propeller was prevented from windmilling by lashing.



Soldier emphasizes miniature details of set simulating part of Nagasaki area. Photo below shows what bombardier sees.



JAPAN- MADE IN HOLLYWOOD

Gen. Henry H. Arnold inspects miniatures. He praised value of movies in briefing air crews.

Revolutionary new briefing technique helped guide our bombs against Japan.

EARLY in 1944 the 20th Air Force was assigned the job of destroying Japan's war industry. The 20th had the men and material but Col. James Posey, 20th AFHQ, soon found that there was precious little intelligence information on which to base this vital strategic campaign. Yet, in a few months, B-29 crews in the Marianas were watching films which simulated exactly their approach to Japan, the bombing runs, and the Jap targets below. These films had been made, not in missions over the Jap home islands, but in Hollywood studios from elaborate sets which reproduced exactly the Japanese terrain. Here is how this amazing job was accomplished.

Through Col. William J. Kingsley, then chief of motion picture services for the AAF, Colonel Posey obtained the services of W/O John R. Glass, former special effects photographer of the Hal Roach studios. Glass set out to build exact miniatures of Jap targets, complete to every town, rice paddy, road junction and water tank. Never before had such scope and detail been required in briefing pictures.

Research Expert Sgt. C. W. Lemming of Tacoma, Wash., assembled thousands of facts on Japan. After determining the location of cities, their approximate size, major industries and the topography of Japan, the motion picture technicians needed photographs of Japanese buildings, rice paddies, agricultural districts and railroad centers from which to construct miniatures. No photographs were available.

Capt. Clifford Herberger determined, however, that at least 90 per cent of the pictures could be made from California terrain. Soon photographers were taking hundreds of still photographs of insignificant buildings and installations.

Other GI experts tested various textures of paperboard, plaster, dirt, sand, fabric materials and paint to produce the Imperial Palace, a Mitsubishi aircraft factory, or a Jap city. Air-

Docks and even ships in the harbor are shown on reproduction of the areas surrounding Yokohama and Kawasaki.

Completed sections on tables (below) are joined with other sections to form an overall miniature of an area.

Tokyo looks like this when approached from a 330° heading. Scores of Jap targets were reproduced in similar detail and photographed from various altitudes and angles of approach depending on bombing missions to be flown.

Tiny factories were carefully located and checked against recon photos after general target areas were completed.

Matchsticks, pieces of piano wire, carefully sketched-in lines of paint become buildings, railroads and streets.

foam from mattresses became Japanese forests. Piano wire served as railroad tracks. The ocean was made by spraying plaster on composition board to form ripples which were painted various shades of green to correspond with the depths of the ocean.

The first target, Ota, 77 miles inland from the coast, required a set at least 90x60 feet scaled a foot to the mile and simulating a view of 2,700 square miles. It was necessary to devise a means of moving the camera over the set—at speed and altitude equivalent to the actual bombing. A new mechanical unit had to be improvised to simulate radar images seen in combat.

The crews worked hard, averaged 18 hours daily. In actual use, the movies proved uncannily accurate. The 20th Bomber Command immediately ordered a series on every major Japanese target, including separate runs from every axis of attack. Special films were made for fire bombing. At least 20 prints of each picture were rushed to Saipan by special courier to be shown over and over to *Superfort* crews. Other prints were sent to B-29 training centers for practice briefings. Of such vital details was air victory over Japan compounded. END

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By Maj. OLIVER STEWART

British Authority, Editor of Aeronautics

WHEN shareholders approved the sale to Vickers-Armstrong of Brooklands Tracks, 22 miles west of London, it was a sad day for those who have watched British aviation grow up. For the great concrete bowl, the only motor race track of its kind in the world, enclosed a small grass airdrome which was the cradle of British flying.

Here, in June, 1908, A. V. Roe (now Sir Alliot Verdon Roe) dodged the police to experiment with his nine-h.p. triplane. Here, soon afterwards, the first aerobatics were seen when the "mad" Frenchman Pégoud looped and flew upside down in a 25-h.p. Blériot before spellbound spectators. Here a private flying club flourished, air races were held and, as the war clouds gathered, the *Hurricane* eight-gun fighter was designed and tested in time for the Battle of Britain.

The 3½ miles of concrete track gashed a landmark in the terrain and the track was torn up and camouflaged when war came. The Ministry of Aircraft Production set up buildings, fine trees were felled, rhododendron bushes torn up and grass smothered.

Your correspondent belonged to the club for over 30 years and used the race track and flew the club's de Havilland *Moth* airplanes. But wars and government departments are no respecters of sentiment and Brooklands was doomed to go the same way as the London airdromes of Cricklewood and Stag Lane.

Costly Flying

Estimates of how much it will cost to fly personal aircraft under the present Ministry of Civil Aviation regulations have been ranging between $8 and $56 an hour.

Depreciation is usually calculated at five years. But, in England, insurance is often dependent upon the skill and experience of the pilot.

In February, Marshalls' Flying School, which does charter work as well as instruction, offered charter rates for aircraft taking from three to eight passengers at fees from 22 cents to 45 cents per mile. Fastest cruising speed offered is 140 m.p.h. with a Percival *Proctor*.

Charter rates are not forced up by gasoline restrictions as are the rates for private owners. Charter operators are the only ones to be allowed to continue as independent companies. But the state corporations, backed by subsidies, will be allowed to compete with them.

Circles And Triangles

A chorus of criticism has been started by the disclosure of plans for the runway system of Heathrow, which is to be London's primary airport. Heathrow is to cost $100,000,000 and is being built on the lines of Royal Air Force airfields, with three concrete runways in a triangle and a perimeter track.

Critics in England have been drawing comparisons between the triangular system of Heathrow and the tangential system of Idlewild, New York, and of Orly, Paris.

Theoretical arguments in favor of the tangential system seem convincing. It allows for many more aircraft movements than are possible with the triangular arrangement.

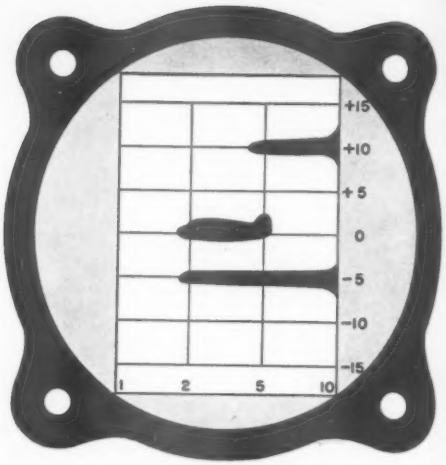
Experienced flying control officers urge that the RAF airfield at Manston, Kent, (see Wartime Crash Strips, page 57, March FLYING), which has neither triangular nor tangential runways, should be employed as a secondary airport for the capital. This airdrome has a single, immensely wide, concrete strip, 3,000 yards long with an additional 1,000 yards for overshoot or undershoot. It is wide enough for light aircraft to land across the runway.

Manston, as one of the RAF's emer-

(*Continued on page* 116)

Percival Proctor has fastest cruising speed (140 m.p.h.) of planes offered for charter service at Marshalls' Flying School in England. Fees range from 22 to 45 cents per mile.

Eventually, when better control units are installed, aerial traffic will fly during bad weather conditions as it now moves on the clearest flying days.



Separation indicator shows a plane 1,000 feet above and four miles away and another 500 feet below and two miles away.

FUTURE AIR TRAFFIC CONTROL

By GLEN A. GILBERT

Chief, Air Traffic Control Division, CAA. Author, "Air Traffic Control."

LONG-range planning for air traffic control has one fundamental objective: Ultimately, it must be possible for air traffic to move safely in the same volume and with the same frequency during instrument weather conditions as is possible during contact weather conditions.

Attaining this objective requires careful planning. Based on the nature of facilities and equipment which will become available, rules for pilots must be developed and procedures governing ground personnel who regulate the movement of aircraft must be established.

A program of improvements has been planned by the Civil Aeronautics Administration which is now being activated and will be completed as rapidly as the availability of funds permits. This program will have the effect of reducing or eliminating many of the limitations of the present system of air traffic control in the United States. Included is the establishment of very high frequency (VHF) radio ranges and instrument landing systems, automatic systems for the handling of flight data and improved approach control procedures based on the use of these facilities.

It is expected that this program will at least quadruple the capacity of the air traffic control system. Instead of landings under instrument weather conditions every 12 to 15 minutes, the improvements planned for the relatively near future will make possible landings on an average of one every three minutes. Instead of 15 minute separations in flying time between aircraft at the same altitude along the airways, the improvements planned will permit aircraft to fly at the same altitude as close as five minutes apart. The CAA has demonstrated on different occasions that it is practicable under approach control procedures to accomplish successive landings at four-minute intervals when using low-frequency facilities and at three-minute intervals when using the VHF instrument landing system.

However, these plans are only stopgaps —they merely extend the effectiveness and increase the efficiency of the present system of air traffic control without providing any basic improvement. Depending, of course, on how rapidly air transportation expands in the post-war era, new plans for air traffic control must be developed and made effective to meet the needs of the more distant future.

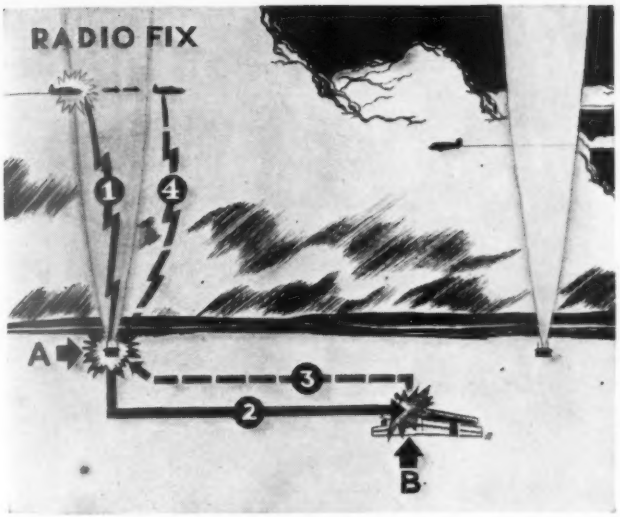
The best index of the amount of future air traffic which will require control to prevent collisions by means other than the pilot's ability to see beyond the cockpit, is the number of aircraft movements (departures and arrivals) expected to operate on instrument flight plans.

Based on estimates of future air traffic development recently made by the Air Traffic Control Division of the Civil Aeronautics Administration, it is estimated that air carrier traffic will provide approximately 10,000,000 instrument flight plan movements yearly by 1950. Nonscheduled flights in 1950 also are expected to provide approximately 10,000,000 instrument flight plan movements, which will be about 20 per cent of the total anticipated non-scheduled cross-country activity. On the basis of these estimates, it appears that in 1950 there will be in the neighborhood of 20,000,000 instrument flight plan movements, as contrasted with approximately 2,500,000 present instrument flight plan movements.

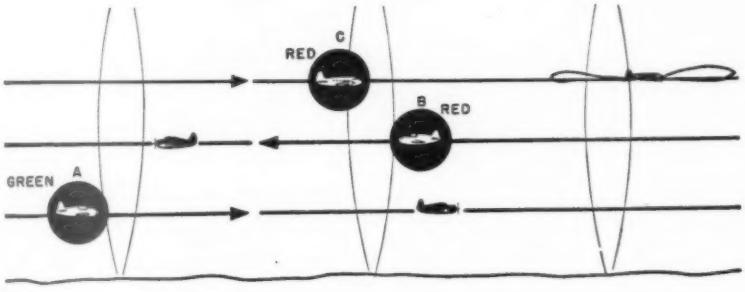
Obviously, then, additional steps must be taken if air traffic control is to be prevented from becoming a bottleneck in the future development of air transportation. These additional steps involve the use of special airborne and ground air traffic control devices, and the establishment of related air traffic control procedures.

One of the most important airborne developments which must be provided for the future control of air traffic is some form of a collision warning device. This device would be installed on the instrument panel of all aircraft operating in instrument flight rule weather conditions and it would indicate to each pilot the position of his aircraft in relation to the positions of other aircraft in the immediate vicinity. To be fully successful, the device must be light, cheap, reliable and easy to operate.

Perhaps the most promising development in this field is a "vertical separation indicator," operating on the principle of radio frequency variation as altitude varies. A sealed aneroid capsule controls the frequency of a low-powered aircraft transmitter, and indications of the altitude of other aircraft within 1,500 feet above and below are shown on a small



Air traffic control data would be handled automatically under proposed plan: (1) aircraft position is reported to ground; (2) report is transmitted to traffic control center; (3) instructions are transmitted to ground radio station, (4) instructions are radioed to plane.



Automatic block signal system would provide added separation safeguard. Perfection of collision warning device, however, would make system unnecessary.

Scanning screens would show actual positions of planes. Left, horizontal cross-section, right, vertical cross-section along a runway localizer.

oscilloscope. This project has been sponsored by the Civil Aeronautics Administration since 1941 but wartime conditions have slowed its completion. Now, however, it is expected that several models of this device will be ready for service testing soon. Other approaches to this problem through application of radar and television also are being studied in considerable detail.

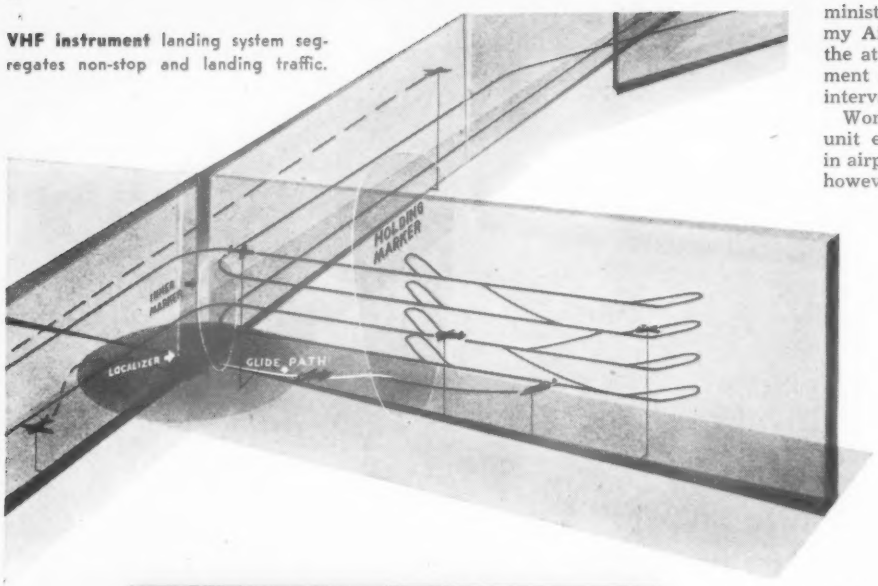
To meet the need for preventing collisions between the large numbers of aircraft anticipated in the future, some means will have to be provided to permit the shifting of a substantial amount of responsibility for the avoidance of collision from ground agencies to the individual pilots of aircraft. Essential to the achievement of this objective is a collision warning device in aircraft which will supplement and simplify the work of the ground traffic control organization. With such a device in use, it appears that the emphasis of the ground system of control will be shifted from the avoidance of collisions between individual aircraft to the maintenance of expeditious, efficient movement of traffic.

Additional special air traffic control developments include an automatic aircraft position reporter which would make possible the instantaneous recording of aircraft positions along predetermined routes. One way to accomplish this would be to have an aircraft trip a reporting mechanism as it passes each fix along the airways in much the same way as a train trips certain signals as it passes a definite point on its route. Aircraft identification, time and altitude over the fix would then be recorded automatically in the proper airway traffic control center.

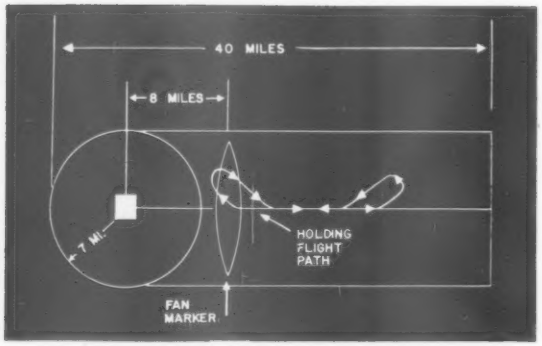
To send instructions automatically to aircraft, a traffic clearance indicator is visualized which would portray to the pilot his current instructions and provide means for automatic acknowledgment. This device should indicate to the pilot visually those instructions involved in being given permission to taxi, take off, climb, descend, hold or proceed while en route, and land.

It is possible that the plans involving automatic position reporting and traffic clearance indicators eventually can be consolidated to provide an automatic block signal system. This system contemplates marker transmitters producing a screen across the airways at "block signal fixes" 10 to 15 miles apart. Aircraft proceeding along an airway so equipped would set up a "hold" light for a succeeding aircraft at that level. This "hold" signal would not be cancelled until the first aircraft had climbed or descended to the next level or had passed to the next fix along the route. Thus, the block signal system would provide a warning to prevent two aircraft from being in the same "block" (the airspace between two adjacent fixes) at the same altitude. A system of this nature probably would not be necessary if a fully successful collision warning device is developed.

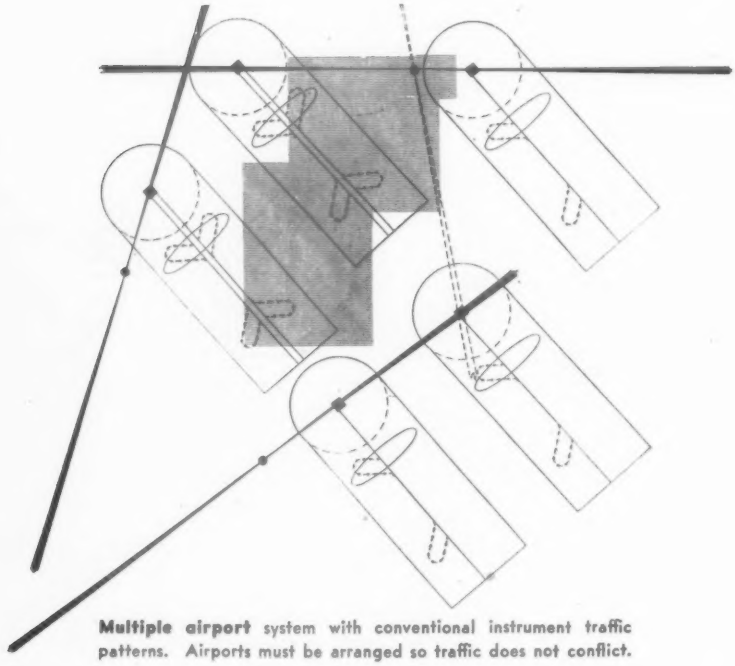
Radar is expected to play an important part in future air traffic control through application in airport traffic control towers. Tests in this connection have been conducted by the Civil Aeronautics Ad-



VHF instrument landing system segregates non-stop and landing traffic.



Conventional instrument traffic pattern needs airspace 40x14 miles. Improvements will cut it to 10x20 miles.



Multiple airport system with conventional instrument traffic patterns. Airports must be arranged so traffic does not conflict.

ministration in co-operation with the Army Air Forces which definitely point to the attainment of landings under instrument approach conditions at one minute intervals.

Work is underway to develop a radar unit especially designed for installation in airport traffic control towers. Initially, however, tests and studies are being conducted by the CAA at its Indianapolis Experimental Station using available military models such as the Ground Controlled Approach (GCA) unit. (See "Pancake in the Soup" page 40.) The airport traffic control tower model would have two screens—one showing a horizontal cross section of the airspace within a radius of perhaps 30 miles and the other a vertical cross section of the airspace along the runway localizer of the instrument landing system.

Scanning screens along these lines should permit much simplification in the handling of arriving and departing aircraft at an airport during instrument weather conditions. Aircraft could be spaced more closely at the same altitude level. Arrivals and departures in large numbers would be possible as the airport traffic controller would be able to watch the actual movements of the aircraft at all times and regulate the flow of traffic with greater precision and safety.

Another development resulting from wartime electronic techniques which will greatly improve the control of air traffic is what may be described as a constant distance-indicating device. This device will permit pilots to determine their distance from special ground transmitters constantly by reference to a distance meter on the instrument panel. Aircraft equipped with this instrument could be held at any specified location along the airway and when approaching an airport could circle at different radii determined by the control tower. This device, in combination with radar scanning screens in control towers, would permit great flexibility in handling traffic into and out of airports.

Let us consider, for a moment, the different categories of aircraft operations which will have a bearing in planning for air traffic control of the future. There will be some aircraft equipped with all of the air traffic control devices, including a collision warning device, a distance indicator, automatic position reporting and a traffic clearance indicator. The majority of these aircraft will be the larger type aircraft of the scheduled air carriers and the armed forces. Aircraft in this category would be afforded a large degree of automatic air traffic control protection with a high safety factor.

Other aircraft, for a long period of time at least, will be equipped only with minimum air traffic control equipment. Aircraft within this category would be the majority of the private aircraft engaging in instrument flight operation and would include, perhaps, some of the smaller mil-

(*Continued on page* 98)

Capt. Kendall D. Gregory

ARCTIC DOCTOR

By JAMES H. WINCHESTER

Captain Gregory practiced parachute jumps during training.

A BIG Army transport plane braked to a stop before the Seattle airport administration building. Gentle hands transferred the litter patient into a waiting ambulance. A half hour later, aided by complicated medical instruments not obtainable at hinterland hospitals, skilled surgeons were removing a bone lodged in the throat of Peter Kurowski who, a few hours before, had been a civilian camp cook for the Army in Alaska, 2,000 miles away.

Three airplanes—a ski-equipped liaison craft, a lumbering converted patrol bomber amphibian, and the transport—had been used to save the cook's life. But for paratrooper-trained Capt. Kendall D. Gregory (now major on inactive status) of Decatur, Ill., the trip was a terse entry in his diary:

"Flew patient to Seattle, administering penicillin all the way. Left Seattle and returned to Nome."

The diary neglected to mention that Captain Gregory had gone two days without sleep, had landed and taken off in an overloaded plane on a frozen lake, or that he and his patient were flown through two sleet and snow storms that kept all other aircraft grounded.

In northern Alaska, where distances are great and the airplane is the only rapid means of transportation, minor injuries and illnesses often assume serious proportions. For this reason, when Alaska became a wartime base of ferry operations to Russia, the Army selected a volunteer corps of medical men and sent them to Missoula, Mont., for special training in the U. S. Forest Service parachute school. Upon graduation, they were sent to Alaska to give medical aid and attention to isolated Army outposts.

Captain Gregory, who had been assigned to the AAF convalescent and rehabilitation program for men returned from overseas, was in the first group to enter the school.

"It's a rugged course," he recalls. "When I first entered the Army in 1941 I applied for the paratroop corps. I was turned down, however, because I weighed over 200 pounds. Weight, though, doesn't make any difference at the Missoula school. The ground training was almost identical with that taught Army paratroopers at Fort Benning . . . how to

(*Continued on page* 102)

Medical equipment carried by Captain Gregory included splints, stretchers and instruments for accident cases, and medicines for men stationed at Alaskan weather outposts.

ENGINE Do's and Don't's

By GILBERT C. CLOSE

When you fool with your airplane's engine, you fool with your life. Leave that job to experts.

WITH the CAA giving a green light to airplane owners wanting to do routine maintenance on their own planes, owners are apt to overstep the none-too-tightly-drawn wording of the Civil Air Regulations and lay themselves open for accidents.

According to CAR 43.20, "mechanical work *other than routine maintenance*" must be performed by a certificated mechanic or a person working under the direct supervision of a certificated mechanic. However, no definite line has been drawn as to what is "routine maintenance."

According to one CAA official, it means daily inspections, oiling, gassing and perhaps making minor repairs. It does not mean making repairs or adjustments which would throw the working of an airplane or an airplane's engine out of line.

Unlike the automobile engine, a breakdown of an airplane engine can mean injury or loss of life and much more costly repair bills. For this reason even the most experienced aircraft mechanics follow a long list of do's and don'ts that may seem lacking in common sense. These

Lake Erie College students repair Lycoming engine. CAA rules that an A&E mechanic must directly supervise their work.

do's and don't's are numerous in instruction books and, because of their number, few have any explanations.

Nevertheless, each do and don't has a background of experience, scientific data or common sense. The best practice is to follow all such instructions implicitly, regardless of personal opinion. Many forced landings have resulted from ignoring those simple do's and don'ts which didn't seem so important.

Al Tucker's crack-up will illustrate this point. Al had been warned perhaps a dozen times never to use substitute parts on his engine. But such warnings were far from Al's mind the morning his gasoline tank cap was missing. As luck and fate would have it, the radiator cap from Al's car fitted perfectly. The engine ran beautifully during take-off, but at 1,000 feet it began to sputter.

Al made a dead-stick landing in a hayfield, ground-looped, and ended up on three points—the two front wheels and the propeller hub. In substituting the radiator cap for the gasoline tank cap he had forgotten one little item. Gasoline tank caps are invariably provided with vents to admit air as gasoline is drawn from the tank, but automobile radiators are provided with an overflow and vents in the cap are unnecessary.

Though Tucker's oversight may seem extreme, hundreds of similar cases could be quoted. A perusal of CAA lightplane accident reports reveals the number of crackups and forced landings caused by ignoring warnings, promptings and common sense suggestions.

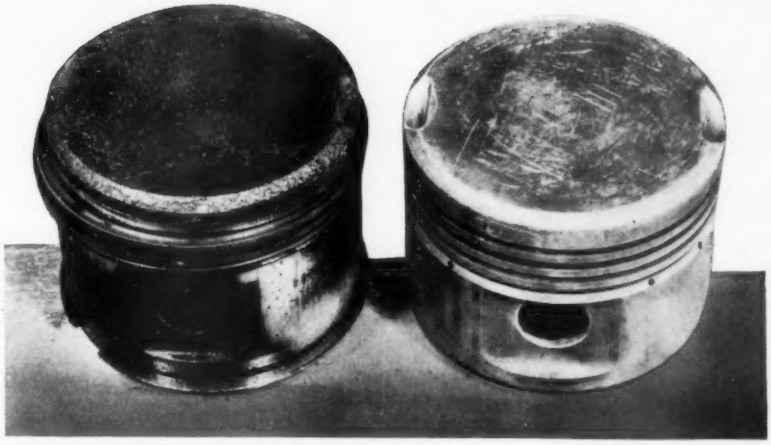
Analysis of these reports indicates that most errors may be classed in one of three categories: (1) failure to diagnose correctly the primary cause of engine trouble, (2) attempting to make repairs and adjustments without adequate facilities or technical knowledge and (3) failure to observe the principles of good workmanship. These faults are not stressed in engine manuals and are covered by the unqualified do's and don'ts. No effort is made to explain "why," or possible results if the instruction is ignored.

Failure to diagnose correctly the primary cause of engine trouble is the major bane of an experienced engine mechanic or a pilot-owner. Many engine troubles, like some ailments of the human body, are symptomatic. Correcting the symptom while ignoring the primary trouble is a quick way to shorten the plane's life.

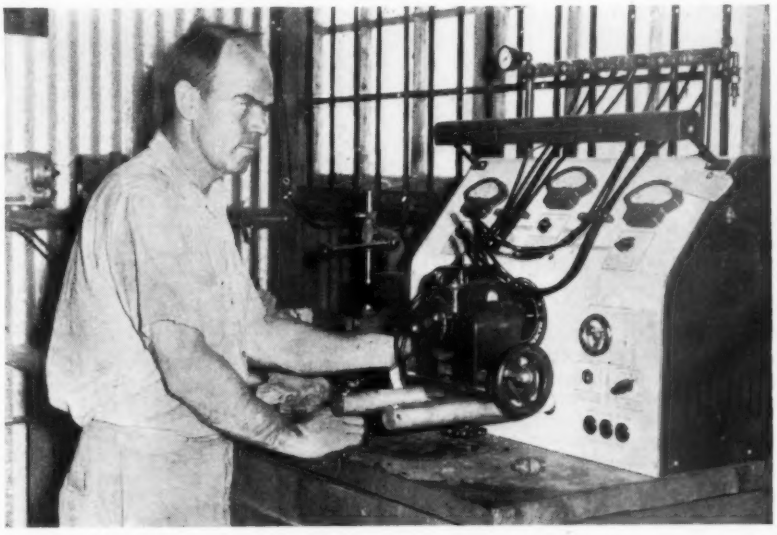
Spark plugs are the most henpecked of all engine accessories. Given a rough running engine, the first thing the average mechanic or pilot-owner reaches for is the spark plug wrench. Ninety times out of a 100 the plugs will be dirty. Then, to increase the delusion of correct trouble diagnosis, the engine will purr like a well-fed tomcat when new plugs are installed. A few hours later the engine begins to lose its new-found vigor and once again the spark plug wrench; once again dirty spark plugs.

Fred Janecke can tell you about spark plugs—Fred used four sets of plugs in 127 hours of flying time. The fourth set came near to being his last. He scraped

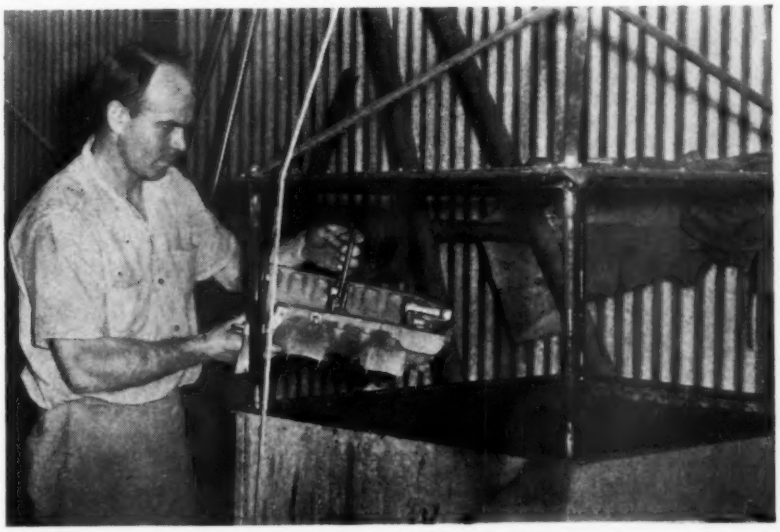
(*Continued on page* 109)



Proper cleaning of engine parts is important in showing up defects. Piston on right is properly cleaned; that on left has a carbon coating hiding serious crack on piston head.



Magneto adjustments should be made only by experts. Precise bench test is essential.



Magnesium crankcase requires liquid cleanser. Same solution might damage aluminum.

What You Should Know About COMPRESSIBILITY

Little is yet known about compressibility stalls, but take a test pilot's advice: they're dangerous.

By ALEX PAPANA
Vice-president, Aircraft Testing Company

VELOCITIES approaching the speed of sound have opened a chapter in aeronautical science with which we are not yet well acquainted. Between 20,000 and 30,000 feet it is not unusual for a fighter pilot to find his indicator showing velocities of 300 to 400 m.p.h.—well inside the compressibility range.

Recently the writer has frequently experienced the effects of high Mach numbers (relation of the speed of the airplane to the speed of sound expressed in percentage—Ed.), and has learned something of their strange effects and dangers.

These flight tests were conducted on *Lightnings*, *Thunderbolts*, *Mustangs* and *Black Widows*, although most of the present information pertains to flights in *Lightnings*. Several series of flights were made to check compressibility symptoms, especially at altitudes between 10,000 and 35,000 feet. Below 10,000 feet it was unusual to reach the compressibility range because of aircraft and engine performance limitations. At altitudes above 35,000 feet, both the indicated and the true airspeeds are low and though the novice might imagine that it would take a long dive to reach high Mach numbers, in actual fact the speed increases so fast that, if the pilot does not observe the airspeed indicator carefully, he will find himself greatly exceeding his anticipated speed.

Pilots expecting to encounter compressibility problems should know these four general subjects:

1. Warnings of approaching compressibility speeds.
2. Reactions to be expected inside the compressibility range.
3. Recovery.
4. Recommendations and conclusions.

A pilot soon learns the "feel" of his airplane at stalling speed. He experiences this sensation thousands of times during his flying career. Eventually this sense becomes highly developed and he instantly detects the threatening stall before it occurs. But the same thing is not true about compressibility speeds.

First of all, we are not as yet "flying" at the speed of sound. Nevertheless, the pilot one day might inadvertently attain a Mach number which will create strange effects upon the aircraft he is piloting.

Combat pilots, while "tailing" enemy aircraft or being "tailed" by their adversaries, were often too preoccupied to detect signs of approaching compressibility speed through one or both of the following symptoms.

When shock waves begin to form, there are signs of a slight but noticeable buffeting and vibration of the aileron. This is almost certain to occur when controls are even slightly out of neutral position. However, this phenomenon will seldom occur when control surfaces are in absolute neutral position. Therefore it is possible that, while in a perfectly straight dive, this warning will not occur.

Another symptom is the fact that the airplane becomes nose heavy. The action may become so strong that it could be mistaken for an elevator force reversal. The tendency of the airplane to accentuate its dive is so great that the small amount of force the pilot is able to use in pulling back on his stick is insufficient and ineffective. Nose heaviness is a characteristic that precedes and accompanies compressibility speed.

On several occasions, while pulling approximately three Gs at an altitude of 28,000 feet with an indicated air speed in excess of 300 m.p.h., the writer noticed an effect similar to that of bullets striking and passing through the wing. Little explosion noises could be heard distinctly, like those of a machine gun. This phenomenon, though, did not always occur while other compressibility effects were noticed.

Alex Papana

If the right type of humidity and temperatures are encountered, the upper surface of the wings may become covered with vapor trails. As a rule, these will be visible from other planes or from the ground rather than to the pilot himself.

The only symptoms which precede the phenomenon and which can warn the pilot are the aforementioned aileron flutter and nose heaviness.

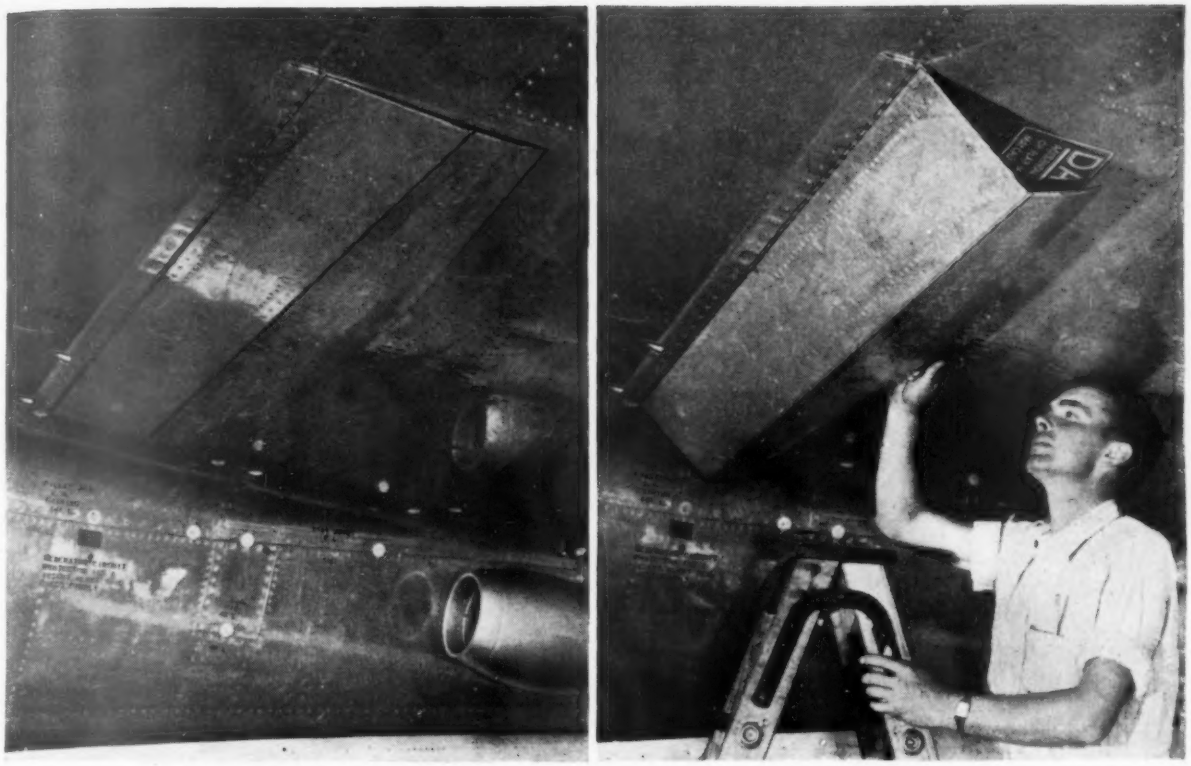
What reactions are to be expected inside the compressibility range?

It is obvious that the air does not flow around an airplane at the same speed at all points. Suppose we fly at an altitude of 30,000 feet and at a speed of 350 m.p.h. indicated. At this altitude the indicated speed of sound is approximately 415 m.p.h. As long as we fly in a straight line, with the controls in neutral position, we might not feel anything unusual. Suddenly we decide to pull or push on the stick. The leading edge of the elevator (at the hinge line) will not be in a perfectly streamlined position with the horizontal stabilizer any more. Because of this the air at that point and at that instant will have to flow around the upper or lower surface of the elevator at a much greater speed, approximately one-fourth to one-third faster. This means that at that point the air will have a speed of somewhere between 430 and 470 m.p.h. indicated, which is inside the compressibility range for that altitude.

From all the data on hand, it appears that in such a case the result is a kind of shock wave, with the point of impact slightly aft of the center of pressure of the elevator. Translated into a "pilot's feeling," this becomes a nose-heavy condition. We have encountered compressibility effects although our airplane is flying at a relatively slow speed and at only one G.

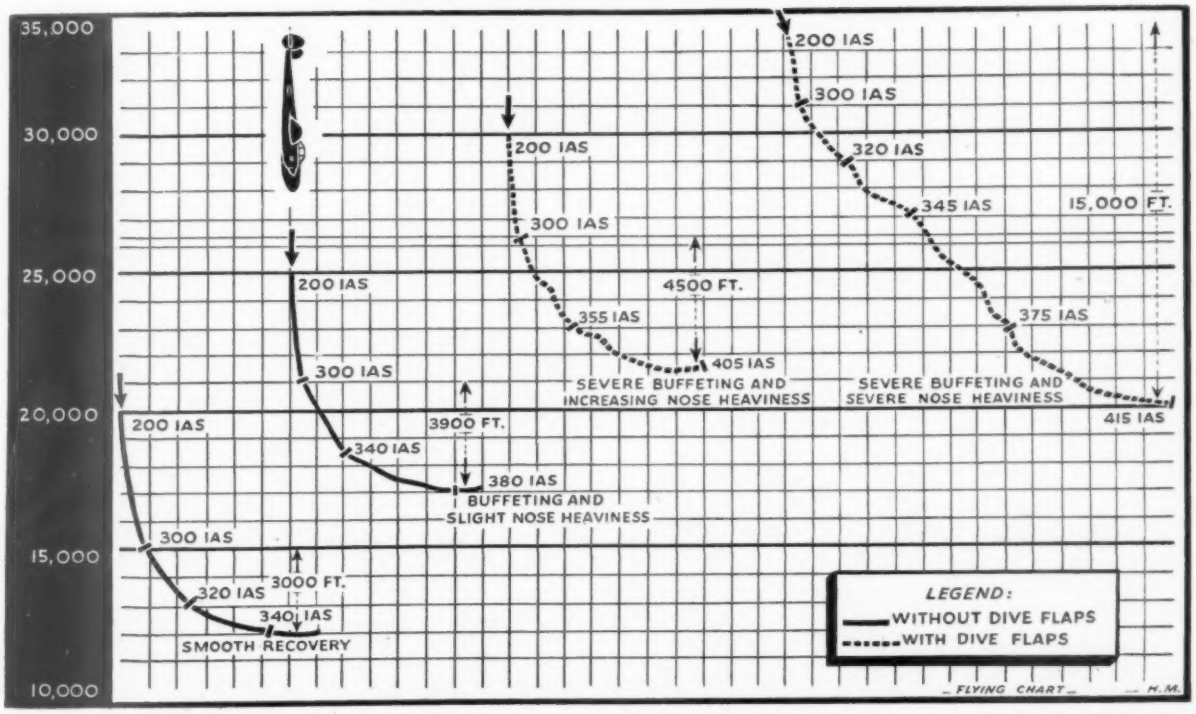
A great deal could be written on this subject but the writer believes that the main point which pilots must keep clear

(*Continued on page* 114)



Dive flaps retracted (left) and open, on Lockheed Lightning are extremely successful in bringing the big plane out of high speed spins. The author says that, so far, the only assurance of safety at high velocities is to be found in such dive flaps.

CHART OF COMPRESSIBILITY TEST DIVES



Graph curves show averages for many of the author's runs with Lightnings. The air speeds may seem low to some who do not realize they are only indicated air speeds. True average air speeds at the end of each dive curve are, respectively, 397, 470, 524 and 531 m.p.h. Two or three Gs were being registered during the pull-outs and the buffeting and nose heaviness were severe.

Have You Seen?

Douglas BT2D-1 is new Navy dive and torpedo bomber with 6,000-pound munition capacity and 1,500-mile range. The versatile craft has twice the range of current carrier-borne bombers, probably is 50 m.p.h. faster than wartime planes of same type.

Southern Aircraft's new Southernaire slightly resembles a Grumman amphibian but is a high-winged landplane designed for small fields. The six-place craft will have a cruising radius of 760 miles with Continental engines. Rangers are on prototype.

Library Use 69

Bruce Parker, champion U. S. water skier, skims behind Luscombe seaplane in Miami Bay at more than 70 m.p.h.

PQ-9 was early AAF target plane with 150-h.p. engine, top speed of 210 m.p.h. It was superseded by PQ-14. The only model cracked up.

Bristol 170 is first British post-war plane built solely for civil use. In passenger and freighter versions, it is powered with two 1,675-h.p. engines, has 100-foot wing span, can carry 5½ tons.

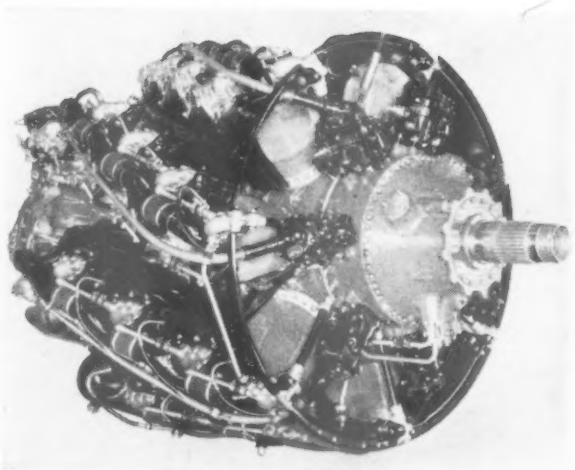
Ghost Hellcat is pilotless target plane with precise radio mechanism which actuates all controls, retracts gear and brakes wheels. It can operate from 2,000-foot runway over 50-foot obstacle.

Have You Seen?

CONTINUED

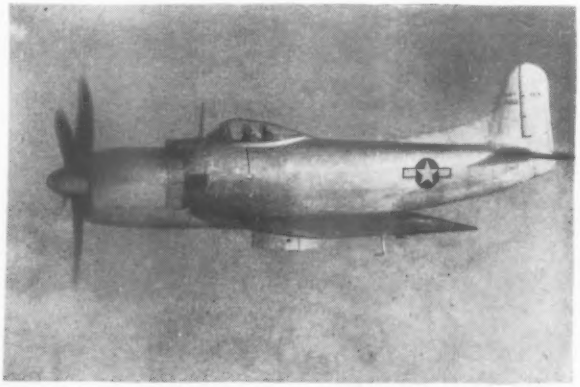
World's first jet-gas turbine-propelled plane is Consolidated XP-81 with GE turbine driving four-bladed prop in nose. Jet engine is in rear. Its maximum speed is more than 500 m.p.h.

Big new Navy fighter, Boeing XF8B has 3,000-h.p. Wasp Major engine driving dual contra-props. Top speed is 400-plus m.p.h.



Pratt & Whitney Wasp Major is 28-cylinder, four-row radial engine delivering 3,000 h.p.—3,650 h.p. with water injection.

North American four-place family plane has 185 h.p., retractable tricycle gear, is expected to sell for about $6,200.



Martin "Mauler" (BTM) carries 4,000-pound bomb or torpedo load externally. Range is over 1,700 miles, top speed over 350 m.p.h.

THE LIBRARY

YOUR FUTURE IN AVIATION, by J. Fred Henry; published by Prentice-Hall, Inc., 70 Fifth Ave., New York, in 1946. 327 pages. Price $3.

This book is a guide for young men and women seeking a future in aviation. In it, the author has heavily documented his text by quoting aviation business and college authorities.

In the text, he covers future aspects of aviation employment from international airlines to small airports. He points out that the immediate future is not as promising as during the war and that only one person in 10 employed during the war in the industry can expect a job.

Much of the book is given over to positions and salaries offered in aviation. While actual flying jobs are covered in detail (requirements, training needed, etc.), ground mechanical and administrative positions are also described.

Military technical and flight training will be valuable, he reports. Shops, employing approximately 85 per cent of aviation workers, will undoubtedly offer the majority of positions.

As for actual flight crews, airlines will want some former bomber and transport pilots. There will be a future need for navigators trained in celestial navigation and college-trained flight engineers for long-distance flights. Fighter pilots, he believes, have no future in airline work.

—C. BUDD DUGAN

WHY HAS AMERICA NO RIGID AIRSHIPS? by P. W. Litchfield and Hugh Allen; published by The Corday & Gross Company, Cleveland, Ohio, in 1945. 143 pages. Price $1.50.

In this study of the characteristics of large ocean-crossing rigid airships, the authors lead up to the question, why doesn't America use all three—the dirigible, the airplane, and the steamship—to provide the United States with the best possible transportation system?

It is high time, say the authors, that America stop thinking of the airship in terms of setbacks and begins to think of it in terms of its possibilities to national growth and security. With its monopoly on helium, the United States has exclusive rights to the airship. Such advantage should be used to attain world-wide air supremacy, the authors contend.

Emphasis on airplanes during the war has minimized the importance of the airship. But they are still useful, particularly in the field of long-distance travel over water. The authors point out that the airship can operate at one-half to one-third the cost of the airplane. Other desirable characteristics of airship travel are absence of air sickness and sea sickness. Airship roominess provides passenger comfort greater than that of the airplane and comparable to that of the steamship.

The book reviews the research work that has gone into airships; the performance of Navy blimps during the war and their ability to operate in fog conditions when other aircraft were grounded; the accumulation of operating experience by Navy and civilian pilots, and gives figures on the projected 10,000,000 cubic foot passenger airship, which would be half again as large as the *Hindenburg*.

Interesting photographs of the nation's famous airships and the people connected with them, as well as colored maps and drawings, are used generously.

—WILLIAM V. HUMPHREY

SHORT VIEWS

GLIDING AND SOARING, by Maj. Alois Sitek and F/Lieut. Vernon Blunt; published by Transatlantic Arts, 79-81 108 Street, Forest Hills, N. Y., in 1945. 118 pages. Price $2.50.

Published in England and reflecting the British point of view on the subject, this book covers the history of gliding and soaring, principles of flight, glider building, and the art of piloting soaring type aircraft.

The book should prove helpful to both beginners and experts in the field. Emphasis is placed on a knowledge of meteorology, the structure of the atmosphere, and the clouds as aids to this new science. Some space is devoted to the theories of aerodynamics and the calculations of glider construction.

AIRCRAFT ELECTRICITY FOR THE MECHANIC, by Charles Edward Chapel; published by Coward-McCann, Inc., 2 West 45th St., New York, in 1946. 477 pages. Price $5.

Here is a ready reference book on the problems and questions which arise in training mechanics and pilots. Written in simple language, the book explains clearly what the mechanic needs to know about aircraft electrical systems and ignition without dipping into complicated theories.

Before the book was published the manuscript was used in teaching Army, Navy, Marine Corps and civilian students. Illustrated with hundreds of charts, diagrams and pictures, the book now comprises a practical course for home study. Typical examination questions, with keys to the correct answers, are placed at the end of each chapter so the reader may check his own progress if he uses it as a home study guide.

END

"We stopped off at Warm Springs."

FLYING

I Learned About Flying From That!—No. 77

By FRED C. SMITH

Test Pilot, Northrop Aircraft, Inc.

Think twice before removing a gear-down indicator from your plane. It can prevent a bad crack-up.

MY WIFE, handing me a letter to mail, gave her usual admonition not to forget it. I told her not to worry about that. "Old Fred has a memory that never forgets."

"Yes, I know," she replied, "but maybe I'd better give you a reminder anyway—how's about a *little red clothespin* on your lapel?"

That clothespin gag—and it really isn't much of a gag at that—goes back to 1938 and the day when, after 11 years of flying, I thought I knew all there was about getting an airplane from here to there. At the time, I owned a Beechcraft, a single-engined biplane with negative stagger in the wings.

When I got it, the Beechcraft had an automatic throttle stop to avoid landing with the gear up. With the stop in place you couldn't close the engine down under 1,500 r.p.m. unless the wheels were down and locked. The gadget was a nuisance and most pilots, myself included, removed it from their planes.

The plane also had a trailing wire antenna which the pilot unreeled behind the plane. You had to retract it by winding it in on a drum arrangement before coming in to land. There wasn't any warning device on this gadget and new antennas cost five bucks. So, I got into the habit of carrying a red clothespin with me in the airplane. After reeling out the antenna, I would clamp the clothespin on the throttle as a reminder of the $5 wire.

I had taken off from Amarillo, Tex., to fly up to the Bivens ranch for a hunting expedition. It was midwinter and I was operating a charter service with the Beech. I don't know exactly why I wasn't clicking that day; maybe I was thinking more about hunting than flying. Anyway, here's what happened.

The boys were waiting for me at the Bivens ranch, and had a pasture cleared for my landing. I circled it a couple of times before they waved me in. I switched on the microphone and told the Amarillo tower that I was going in at the Bivens ranch. Then I carefully wound in that five-buck radio antenna to keep it from snapping off when I landed.

I racked the antenna reel in to the last stop and checked it carefully. Then I removed the clothespin from the throttle and clipped it to my lapel. I throttled back and came in under a little power in a long shallow approach. Just over the edge of the field I saw the boys waving furiously—with impatience, or so I thought.

Then I came smashing in on the belly in a shower of sod and dirt. The spinning prop rang on that hard ground a couple of times like the Liberty Bell. Then the Beech reared up a little and skidded tail-high to a stop.

I stood up and climbed out, swearing. My hunting companions, who saw I wasn't hurt, were laughing like hyenas. At that time I just couldn't see the humor of it.

The worst joke, however, was one that my mechanic pulled after I'd got the plane trucked back to Amarillo. He looked over the damage and figured that it would cost about $500 to repair. Then he hesitated.

"Lose your radio antenna, too?" he queried.

"No," I said. "I had a clothespin clipped to the throttle to remind me about that."

"Then it ain't so bad," he said, without smiling. "If you'd wrecked that antenna it would have cost you maybe $5 more. It shore does pay to be methodical, don't it, Mr. Smith?"

That taught me one thing about airplanes and maybe I lean over a little backwards now. I don't trust the gear-down indicators on even the best planes. Lately, I've been insisting that the mechanics keep the cowls carefully polished on the *Black Widows* which I've been test hopping for Northrop Aircraft.

There's a reason. The *Black Widow* is big and rugged and the nose wheel of the tricycle gear is invisible from the pilot's seat. But those polished black cowls are as good as mirrors if you want to be sure the nose wheel is down—and I want to be sure. That's one thing I've learned about flying! END

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WILLIAM T. PIPER, *President*

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AOPA NEWS

The Aircraft Owners and Pilots Association (AOPA), with National Headquarters Office located in the International Bldg., 1319 F Street, Washington 4, D. C., is a non-profit organization composed exclusively of pilots. It looks after the pilot's best interests in all phases of aviation and helps individual pilots with their individual problems. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is edited by the Aircraft Owners and Pilots Association and opinions contained in it are not necessarily those of FLYING. A special bulletin is sent each month to all registered AOPA pilots and also confidential newsletters from AOPA's Washington staff are sent members from time to time

INITIAL SURVEY RESULTS

SEVERAL thousand cards remain untabulated as we go to press this month, but AOPA's staff has gathered some interesting facts on the way AOPA pilots are using their aircraft.

Of course, AOPA pilots will receive the final results as a part of their regular membership service, but initial tabulations covering the first few thousand AOPA members have produced the following general observations.

Business use of AOPA aircraft by members is the greatest ever reported in AOPA tabulations; pleasure use is slightly on the decline, and combination use (business and pleasure) accounts for approximately 67 per cent of all AOPA aircraft usage. The ratio of pleasure to business use is about 14 to 11; i.e., for every 14 AOPA planes utilized primarily for pleasure, 11 AOPA planes are used for business. Since AOPA-registered pilots own over half of all civilian non-scheduled aircraft, these figures may be taken as a representative picture of non-scheduled flying nationally, assuming, that the completed tabulation will uphold these preliminary returns.

Most AOPA pilots who have aircraft on order expect to use them for a combination of business and pleasure, with business predominating. This is probably a significant trend as AOPA officials believe that it will increase the average number of hours flown by personal aircraft each year, increase the average operating radius of non-scheduled aircraft, and finally, that it will level out the present "peaks" in private flying, viz., greater use of personal aircraft during week days and less seasonal variations. It is also assumed that more instrument and marginal weather conditions will be flown by non-scheduled pilots.

The breakdown of AOPA members' aircraft according to type is also interesting when compared with previous surveys. This study shows some increase in the number of higher performance aircraft and a reduction in the number of strictly "trainer" type. A desire on the part of the more seasoned pilot for greater passenger and baggage accommodations also is indicated. Spot-checking present members' reports against their master files in AOPA headquarters shows that the second airplane purchased is almost always either faster, larger, or otherwise more adaptable to cross-country flying than airplane number one. In this respect, the present survey confirms earlier studies disclosing an overwhelming desire on the part of AOPA pilots to own a four-five place personal aircraft which could accommodate the family group. Such preference, however, usually has not been noted until after the pilot completes training and early cross-country flight experience. It appears first with the pilot's search for utlity in his aircraft and usually after "airport circling" has lost its fledgling charm.

In many respects this survey brings out AOPA's previous contentions as to improvements needed not only in personal aircraft design but in airport operation, positioning of airports, elimination of both Federal and state red tape, a clean-up of regulations (a job only just started), etc.

If non-scheduled flyers use their aircraft for business, there will be even greater demand for better airport service, more built-in aircraft utility and safety, airports close to city centers, a minimum of regulations, less CAA-CAB emphasis on air-carrier problems and more on non-scheduled aviation, elimination of duplicating state regulations and "pork barrel" airport landing fees, plane and airman license fees. All of these ills and many more are AOPA's targets. The co-operation of public organizations and interested individuals in AOPA's active program is increasing and is most welcome. Non-pilot readers of this column can identify bona-fida non-scheduled pilots by looking for the AOPA lapel pin. Only bona-fide pilots may wear the AOPA wings and each AOPA pilot carries identification credentials of the organization, including an individual AOPA registration number as evidence of his professional standing. All AOPA pilots are pledged to assist in making flying "more useful, less expensive, safer, and more fun." They desire the full support of interested public groups.

CAA LANDING SYSTEM CONDEMNED

AOPA has presented detailed information on the CAA-sponsored "landing system" and the GCA (ground controlled approach) system in recent pages of the AOPA *Pilot*. CAA's support of the "localizer-glide-path" system and their unexplained indifference to the newer GCA system was discussed at length and AOPA pilot reactions to these presentations were instantaneous and vigorous. AOPA's position not only was upheld but many pilots indicated a desire to see an even more drastic program to curtail much of CAA's program and "force" CAA to adopt the GCA system because of its universal adaptability for private flyers (with no costly equipment to buy for personal aircraft). AOPA Pilot 17327 from Arizona writes:

"Dear Friends: I should like to give my hearty endorsement to the viewpoint expressed in the recent issue of the AOPA *Pilot* concerning the relative utility of the CAA instrument landing system and the GCA method utilizing radar control.

"I have had some experience as an Army instrument flight instructor. There is no question that the CAA localizer-glide-path method requires a far higher degree of pilot proficiency. Airline pilots who are experienced instrument pilots could undoubtedly adapt themselves quite readily to this method, but for the private pilot who will make an instrument let-down only occasionally, the CAA method is virtually useless.

"Among the advantages of the GCA method for the comparatively inexperienced pilot are these: The problem of the let down and low approach become merely one of basic instrument flying. The pilot concentrates on precisely the points which have been drilled into his head in the course of his instrument instruction, that is, control of air speed, altitude, heading and attitude. These require visual concentration only on those instruments with which he is most familiar. The radio instructions (given during a GCA approach) resemble the instruction from an instrument instructor in the front cockpit and so present no new and strange problem. If a pilot has qualified at all for an instrument rating, it can be assumed that he can fly the plane at a given air speed, at a given altitude or rate of descent and on a given heading when told to do so, and nothing more is required in the GCA system.

"The introduction of an entirely new visual instrument (required in the complicated CAA system) is invariably upsetting to a pilot to whom instrument flight isn't already second nature. The new instrument exerts a fascination and the pilot tends to stare at it and to ignore the more familiar ones.

"One further factor increases the safety of GCA for the inexperienced instrument flyer and that is there is a double check. The ground controller can see immediately if the aircraft is too far off the proper approach and can direct the pilot to pull up and try again if he regards it as necessary.

"Without this double check, the green pilot either may be overconfident and allow himself too wide a margin of error or become tense and nervous because of lack of confidence in himself. These are the typical reactions of pilots flying the CAA approach system. With GCA the pilot is relieved of the final decision of

(*Continued on page* 100)

SKY-PROVED PROTECTION FOR SKY-BRED TAYLORCRAFTS!

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HANGAR FLYING

LOCKHEED

6 Designs for a Windshield

The people in the Engineering Research building at Lockheed, Factory B-1, Burbank, point out that the unique windshield design on the *Constellation* didn't just happen. Five experiments preceded it.

Windshield No. 1 went into a completely faired nose. It looked good on paper, but when it was mocked up Lockheed found that vision for pilots was bad.

Type 2 was an attempt to put the crew "downstairs". This turned out to be a failure because it would have been pretty uncomfortable in a belly landing. This is the way it looked:

The engineers next tried two small bug-eyes, which were successful only in giving the crew claustrophobia. Discard No. 3:

A wide, single bug-eye type was tried next, but was found difficult for pressurization.

Fifth was a conventional "Vee" windshield, but the fuselage was too big to allow for an effective design.

The sixth windshield was adopted. Besides being the lightest of all, its many small panels give excellent vision angle as well as convenient control and instrument arrangement.

This kind of inspired persistence is going on all the time at Lockheed—the kind that makes good planes and good telling.

L to L for L

©1946, Lockheed Aircraft Corp., Burbank, Calif.

Letters

Reader comments should be addressed to Letters Editor, FLYING, 185 N. Wabash Avenue, Chicago 1, Illinois. All letters should be signed. Names withheld upon request.

CARBURETOR ICING

The article in the February issue of FLYING entitled "I Learned About Flying From That!" by Robert Schwartz may soon be followed by another article of Bob's entitled "I Did It Again" or "Watch That Carburetor." It is inconceivable that a man with 23 years flying experience would make the statement that "the air temperature at my altitude (2,400 feet) was 38°, so I felt sure the carburetor couldn't be icing up"? But that is precisely what he said in column three on page 87.

Bob makes no mention of trying carburetor heat when his r.p.m. dropped. Surely a man of his experience knows that carburetor ice can form even when the ambient temperature is a good deal above freezing. Apparently he has forgotten that the venturi pressure and temperature drop plus vaporization of the gasoline may cause a sufficient decrease in temperature to form ice in the carburetor, even with the outside temperature much above freezing.

We would like to refer Bob to your article entitled "How to Fly in Winter" in the same issue of FLYING. We suggest he read particularly the part entitled "Watch for Carburetor Icing" on page 114 which verifies the statement above.

CAPT. RICHARD G. ILLING, A.C.
LIEUT. ARNOLD A. BEGUHN, A.C.
Dayton, Ohio

BLERIOT OR BRODIE SYSTEM?

I noted the article "Clothesline Air Strip" in your December, 1945, issue of FLYING.

However, it seems that Capt. J. H. Brodie's unique "Brodie System" was dreamed up about 32 years ago by none other than that famous air pioneer, Louis Blériot.

Although it took me a bit of time to locate such proof it can be found by consulting the *Textbook of Naval Aeronautics*, by Henry Woodhouse, published by Century Company, New York, in 1917.

Under the sub-title "Recovering Seaplanes at Sea," second paragraph, page 33, will be found:

"In 1913, Louis Bleriot, the French inventor and aeroplane manufacturer, conducted experiments intended to show the practicability of recovering seaplanes at sea. The device, consisting of highly suspended cables, to which the aviator was to fly and hook onto by means of an automatic clasp connected to the body of the aeroplane, was tried at Buc, France. Pegoud, the first man to loop-the-loop, flew the light Bleriot monoplane to the cable, engaged it with the catching apparatus, the latch automatically grasped the cable, and the machine came to a standstill. Then the propeller was again started, the latch-cord pulled to release the machine, which flew off without mishap."

A fairly complete picture of what is basically the same rig employed by Brodie is shown on page 31 of the book.

With all due credit to Captain Brodie, just who was the clothesline dreamer?

JO RO JUNG, JR.
Ex-AAF Cadet

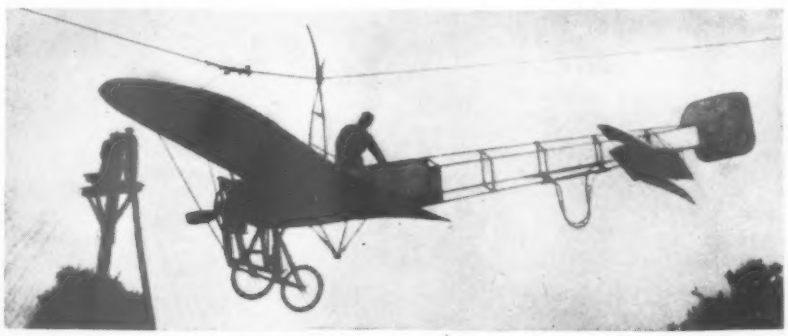
● Checking through the "Textbook of Naval Aeronautics" we find Reader Jung's statement essentially correct. Bleriot's device (shown below) was judged "impractical," however.—ED.

AIRPORTS OMITTED

Flying students here have noticed the omission of my airport from FLYING's interesting report (January issue) entitled "Ports for the Private Plane: New York City." Ours is the pioneer airport on Staten Island where it has been in operation for 18 years.

We have two operators at this airport, the Richmond Flying Service and Globe Airways, and have five *Cub* trainers, a

(*Continued on page* 111)



Louis Bleriot's cable landing system in 1913, 32 years before Brodie system was invented.

Gadzooks, sir! Pull in your beak

"Functional, sir, functional, that is," orated the plane salesman glibly, spinning the blades on the mower-type wheels.

"This little plane, sir, is the absolute epitome in functional design. It'll take off from any field . . . mows the weeds and grass as it goes! Shears your front yard closer than a billy-goat! The effortless way to trim the side hedge! In fact, sir, it falls short of nothing except clipping the back of your neck. . . .

"Gadzooks, sir! Pull in your beak."*

*And you, Mr. Salesman, better pull in your oars. That mower-gear dream's as wild as we've heard. Sure, we know there's a great day coming with tomorrow's new planes. We know, because there'll be a new WACO in the air by early fall. But the improvements by WACO will be along more practicable lines . . . along lines that will uphold the 24-year WACO tradition. So watch for the plane that is traditionally comfortable, dependable, easy to fly. Watch for the new WACO early this fall —as always, a *better* plane—for *better* flying! THE WACO AIRCRAFT COMPANY, 44 Peters Avenue, Troy, Ohio, U. S. A.

SINCE 1922 • *BETTER* PLANES FOR *BETTER* FLYING

WACO AIRPLANES

Waco

Landings in the Soup

(*Continued from page 42*)

—bring it down just a little . . . that's fine. . . . Glide path very good. . . . Still two-nine-zero. . . . Your heading is two-nine-zero. . . . Two miles from end of runway. . . . Glide-path good. . . . Mile and a half from runway. . . ."

Like scooting down a sliding board when you were a kid—that's this glide-path business!

"One mile from runway. . . . Two-eight-eight is your heading. . . . Two-eight-eight. . . . Going above the glide-path 20 . . . 10. . . . On glide-path one-half mile from end of runway. . . ."

You're squinting now. What runway? You don't see—but wait. You do! There it is, directly ahead, looming out of an opaqueness that you know stretches 5,000 feet up.

"Runway straight ahead. Take over visually. This is the National Airport Ground Control Approach director. Out."

Almost at the same instant your wheels touch and you are down on the ground once more. Five thousand feet of soup and you came through it to make a landing. You and your "co-pilot" . . . the GCA controller!

How did he do it—what brought you down? You did not line up cross-hairs on an instrument face nor did you switch gadgets on and off. In fact, you flew your plane as you would on any conventional landing except that you were given constant compass headings to follow and coached on your rate of descent, making the landing easier than usual. There was nothing new that you had to have except, perhaps, confidence in someone's judgment . . . and some equipment.

This equipment is a mobile ground radar system that provides all the facilities for directing the movement of aircraft over a pre-determined glide-path for a safe approach to an airdrome runway under conditions approaching zero visibility.

Born of the war, used successfully on Saipan and Iwo Jima for bringing in *Superfortresses* during the closing months of the war, Ground Controlled Approach, or GCA, may well become radar's greatest peacetime application. Every airport in the country may soon have its own GCA equipment and crew to bring planes in to land during "ceiling zero" conditions. Airline officials sat in on some of the trial runs conducted by the Army and Navy during the war and are enthusiastic about its possibilities already. Yet it will be the future private-licensed pilot with his air flivver who will most appreciate this amazing combination of radar-radio for bringing him in on that all-important safe landing.

Here is a method of landing during periods of low visibility that eliminates the chief difficulty of all such systems of the past—the need for heavy and usually expensive equipment that must be installed as "extras." A radio which is already standard equipment in all planes is all that is needed to land a plane in almost any kind of weather. All directions are given on a standard frequency radio band. The very special radar equipment necessary to "talk down" a plane is located in a trailer set up on the airfield approximately 300 feet from the center line (to the pilot's left on an approach), of whichever runway is being used and approximately 3,000 feet from the downwind end of the runway. It is easily recognizable by the large search radar antenna reflector mounted atop the trailer.

As you enter this trailer, about the size of an extra-large house trailer, the first thing you notice is the jungle of electronics equipment—illuminated PPI radar scopes, shining dials, strange gadgets. When the van is in operation, the only light comes from the PPI radar scopes, round lighted discs, seven inches in diameter, on which appears a small blob of light showing exactly the position of any aircraft in the air. One of these radar scopes scans the territory for 30 miles around the airport. This is the search radar for making the initial contact. The plane then can be directed to the "glide-path" area, scanned by a precision radar set that provides continuous range, azimuth and elevation information on the plane being controlled on the final leg of the flight.

Usually five men make up the crew in the trailer, four of them "reading" radar scopes while the fifth is the controller or final director who talks the pilot down the glide-path. In the air, you would hear the voices of three of the men, two of them bringing you into position for the final leg, and the controller who gives constant instructions to you as you come down the glide-path. These men all wear earphones and microphones and a push-button arrangement makes it simple for them to "tune-in" on whatever radio channel you may be using.

When you call an airport from a plane and ask for GCA assistance in bringing you in, the first voice you hear from the GCA trailer is that of the No. 1 director or radar scope reader. He sees you on the round PPI disc with the 30-mile range as a small blob of light moving on a darkened background. If you were a pilot familiar with GCA procedure you would call in:

"Hello Maryville Airport, this is NC-172. Request ground approach control. Over."

And it would be No. 1 director who would answer: "NC-172, this is Maryville GCA. What is your altitude, heading and approximate position?"

You would give him this information and he would pick you out on the PPI scope. If he were doubtful just which blip you represented he would give certain steers so you would be flying in a pattern he could recognize on his scope. Once you were identified he would report to you over the radio channel you are using:

"You are in sight."

No. 1 director assigns your altitude and heading to start you on your landing circuit. No. 1 director gives you the necessary information concerning altimeter setting, field elevation, runway dimensions, wind data. No. 1 directs you to perform your landing cockpit check. No. 1 is a combination "Information-please" and super-navigator who, by careful radar checks, brings you to a point where you begin your crosswind leg of the landing pattern. At this point, No. 1 director tells No. 2 director, who is the next man to his left, your call, range, altitude, heading and radio channel.

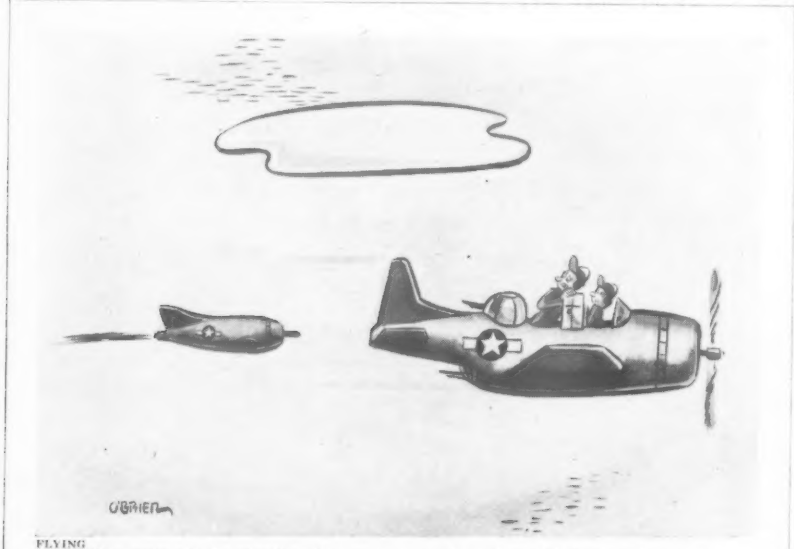
Then on another PPI scope, identical to the 30-mile maximum range scope used by No. 1 director, No. 2 director picks you out. What he sees is a small blob of light moving slowly across the round disc like a tiny illuminated or "glowing" caterpillar, if you can imagine such a creature, moving over a black phonograph record. That is the so-called "PPI picture." He directs you:

". . . Steer right to one-six-zero, over."

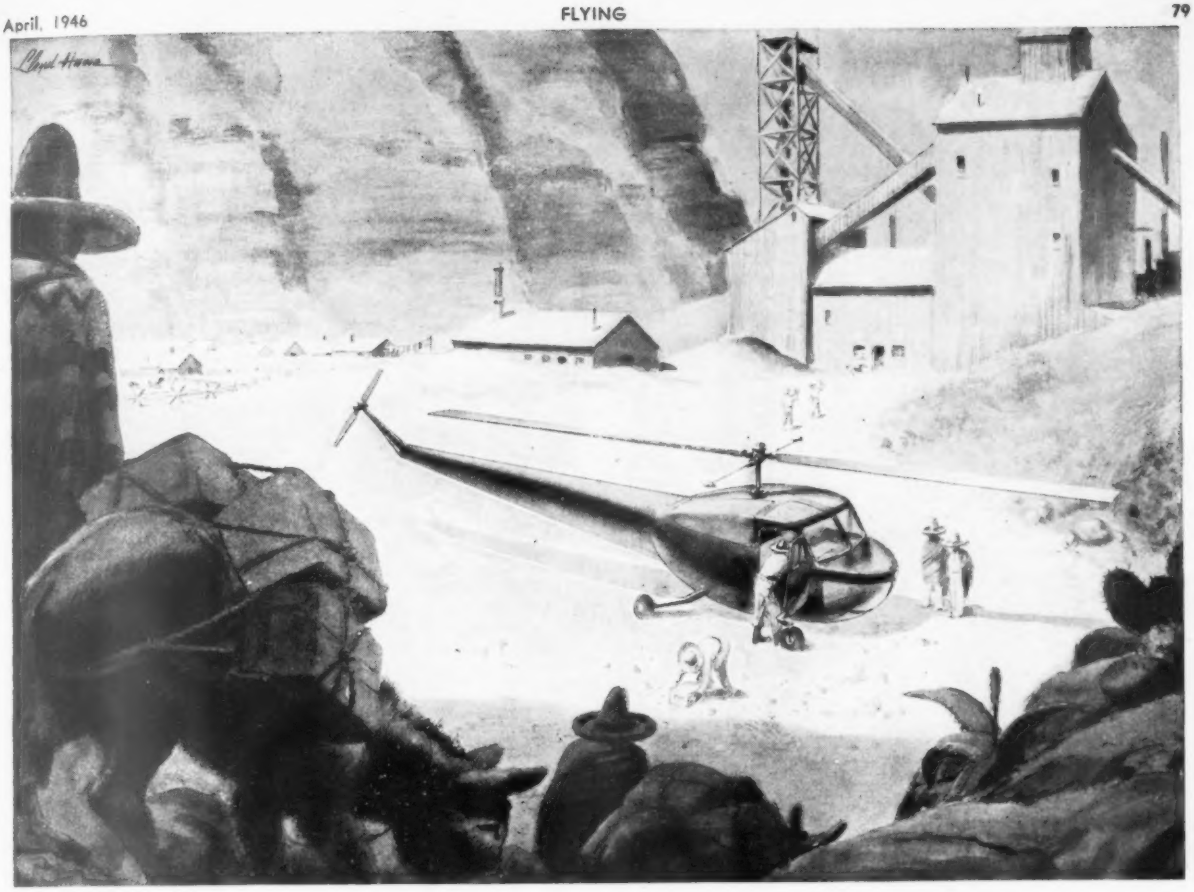
You follow directions.

"You are on your crosswind leg seven miles from the airport. Fly at 2,500 feet. Over."

Thus the No. 2 director brings you to a point where you start your upwind ap-



FLYING "Remember that radar bomb we were experimenting with last week . . . ?



"The Modern Magic Carpet"* Will Blaze New Highways to Inaccessible Places

BECAUSE of their ability to ascend and descend vertically... fly forward... backward... sideways... hover ... and land in and take off from any terrain where sufficient space is provided for the clearance of the rotors, helicopters will blaze new highways in the sky to hitherto inaccessible places.

These "Modern Magic Carpets"* will transport men and supplies swiftly and economically to localities and plants so out-of-the-way that they often are reached only by mule team or "shanks' mare."

Since Bell Helicopters will need no elaborate landing fields and terminal facilities they will offer Business and Industry the many advantages of fast point-to-point delivery.

Bell Helicopters are being built to perform many practical commercial, industrial and military applications for which the helicopter is more suited than conventional fixed wing airplanes and other forms of transportation... and, in fact, is sometimes the *only* means of transportation.

Bell Aircraft's post-war interest in the helicopter is in engineering and building rotary wing aircraft incorporating the advanced design, workmanship and dependable operation which has won this company its place in the Aviation World for being the "Pacemaker of Aviation Progress."

*Reg. applied for U.S. and principal foreign countries.

BELL *Aircraft* CORPORATION

Buffalo 5, New York

© Bell Aircraft Corporation

PACEMAKER OF AVIATION PROGRESS

proach along the "glide-path." Here the final controller takes over:

"Steer right two-nine-zero . . . you are on your final leg. . . ."

Now you are within the radar precision system of GCA in both azimuth and elevation, a system so exacting that repeated tests made in Gainesville, Ga., proved the elevation beam to be accurate within six feet and the azimuth beam within 20 feet.

The precision system is the ultimate in complex radar gear—yet the operation of this system is so simple that after a few minutes of instruction almost anyone of normal intelligence can bring a plane in successfully with radar.

Three men are required to operate the precision system—the final controller who talks to you on the radio during the final leg of your flight, and two radar operators—one for watching your rate of descent on the PPI scope and the other for checking the direction in which you are flying. A pre-determined glide-path has been established and is actually drawn on the glass overlaying the black background.

GCA sets of the future can be expected to operate with smaller crews—in fact, Gilfillan Bros., Inc., of Los Angeles, wartime radar manufacturers, have already designed a simplified system. This is called RLC ("radar landing control") and uses only two radar scopes, both of which will be read by a single "talker"—thus reducing radar landing to a one-man operation.

In the military scopes described here, however, the radar operator watches your rate of descent with two PPI scopes, one with a 10-mile range, the other a three-mile range. Visualize two phonograph records again, with a line cutting off the lower third of each. These are ground lines showing the actual ground level of the runway. Looking at these two discs is exactly like looking out of your window where you see the horizon and the sky. The radar operator first notices the tiny blob of light, representing the airplane, on the 10-mile scope. As it moves within three miles of the airport, the moving blob of light appears on the three-mile disc, greatly enlarged. The operator constantly turns a crank to keep a hair-line or "cursor" on the blob of light. The difference in feet between this cursor, representing the actual position of the aircraft, and the established line—or glide-path—is automatically cranked into a meter known as the error meter.

This meter is directly in front of the final controller who "talks down" the plane on the final leg. This meter looks exactly like a temperature meter on the dashboard of your car, with a moving needle that points to the figure representing the number of feet off the glide-path the plane happens to be. Thus, if the needle is at "50" above the glide-path point, the final controller simply talks into his microphone to tell you up in the air: "down 50." He watches as the needle slowly drops down to the glide-path point . . . "down 40 . . . 30 . . . 20 . . . correcting nicely . . . on glide-path."

On the other side of the controller, another radar operator watches two more PPI scopes, one with a 10-mile range, the other a three-mile range. These scopes show the position of the plane from the airport as far as direction is concerned. He too constantly turns a crank to keep the cursor on the moving blob of light. The same procedure is followed that is used for the elevation PPI scopes. The final controller has another error meter in front of him which he uses for correcting azimuth. In this case he corrects by degrees, giving compass headings for you, the pilot, to fly:

"Your new course is two-seven-zero . . . two-seven-zero."

Controllers usually correct in five degrees only out past the two-mile range, to make it easier for you to keep on a compass heading. Once a plane is within two miles of the runway, the controller will correct, giving the exact compass headings:

"Your new course is now two-eight-eight . . . that's two-eight-eight."

Most planes are "on course" almost immediately after making their turn from crosswind to the final leg, and few course changes are necessary.

On the three-mile range elevation scope, the picture of the terrain is so complete that houses, towers, radar vans and the like show up as permanent blips that take on characteristic shapes of these objects. For this reason it is possible for the controller to give useful information to pilots on possible hazards, such as:

"You are 600 feet above the Empire State Building. . . ."

With two radarmen doing the actual tracking of the aircraft on the precision system and cranking in the errors on elevation and azimuth into the error-meter, the approach controller has all information necessary for a successful "talk-down" approach; he is not hampered in this performance by having to do the manual work of maneuvering the cursor to check the path of the incoming plane.

The philosophy which started GCA on its way was this: if microwave radar can locate a plane from the ground precisely enough to shoot it down, it is capable of the more constructive task of guiding a plane to a safe landing under blind flying conditions.

This basic idea was conceived in November, 1941, by Dr. Luis Alverez and was first tried at the Radiation Laboratory of the Massachusetts Institute of Technology. It was decided at this time that GCA would make a clean break from conventional blind landing systems. Instead of putting the information on a meter in front of the pilot, it would be told to him verbally. This would elimiate the need of new equipment in the planes and the pilot would have most of his thinking done for him by someone on the ground.

The first experiments using aircraft were conducted at East Boston Airport and at the Quonset Point Naval Air Station, using gun-laying radar for the precision system. It was obvious from the beginning that this equipment was not sufficiently accurate at low glide-path angles to bring planes in for an approach successfully, but it did prove that the "talk-down" principle was good provided the controller had accurate information as to the elevation and azimuth of the aircraft at all times. The Naval Radiation Laboratory group at M.I.T. then developed special radar antennas and a presentation for high precision radar at low angle, combining this with a search system for traffic control. This was ready for a test a year later, in November, 1942.

The first GCA equipment was a big success operationally, but technically not practical for forward area use by the Navy. This brought about the development of the present GCA sets which were tested by Navy operational personnel and were accepted by the Chief of Naval Operations in August, 1944.

The first sets were set up in Gainesville, Ga., Whidbey Island, Wash., Attu, and in Africa. In six months, approximately 10,000 successful approaches were

15 YEARS AGO

FROM the April, 1931, issue of this magazine:

A new and accurate photographic method for measuring the landing speed of airplanes was described. Wheel or tire of the plane was painted in contrasting colors and the rotation of the wheels was later counted in movies taken of normal landings.

American Research Foundation adjudged wood superior to metal for airplane construction. Their tests showed chemically treated wood to be more fire-resistive than metal and more flexible.

Earle J. Smith of Stinson Aircraft Corp. predicted that the airplane of the future would be a combination plane, automobile and boat, would have a speed of about 80 m.p.h. on land and water, and about 200 m.p.h. in the air.

Junkers Works at Dessau, Germany, announced that airplanes with only a single engine henceforth would be the standard type produced. For future giant planes, Junkers planned to have two power centrals, each operating two or possibly three propellers.

Taylor Brothers' Aircraft Corp. introduced the Taylor *Cub*, priced at $1,325. It was powered with a Continental 35-40-h.p. engine. The company claimed that beginners could learn to fly the *Cub* in from two to four hours because of its unusual stability and maneuverability.

Under the patronage of the Royal Aeronautical Association, Japanese boys had started to build model airplanes. At a competition in Tokyo more than 200 contestants took part.

Curtiss-Wright announced the *Junior*, a two-place pusher monoplane powered with a three-cylinder, radial, air-cooled, 40-h.p. Szekely engine. Plane's range was 200 miles; cruising speed, 70 m.p.h. Cost: $1,490.

The Navy announced its new submarine plane—a tiny monoplane-type flying boat which could be folded up in three minutes and dropped into an eight-foot tube despite the fact that it had a 38-foot wingspread.

A newly-designed Hamilton Standard propeller with a variable pitch adjustment that could be altered during flight was tested. Manipulated from the pilot's seat, it reduced the plane's take-off time from 30 to 20 seconds.

Light as an empty suitcase the LEAR *PXer*

• Here's a complete light plane radio that weighs only 15 pounds. And that includes everything — transmitter, receiver, power pack, headphones and mike.

It lets you contact control towers, fly the beam, and keep track of the weather ahead. Use it with a loop and it becomes an efficient aural-null direction finder.

The PXer takes only a hair over 5" x 6" on the instrument panel — the power pack and jacks for mike and headphones can be put wherever you want them.

To top all this, the price of the PXer hits a new low for a precision-dependable Lear Aircraft Radio.

Get all the details on the PXer. And if you'd like to consider being a distributor ask about the franchise. Write LEAR, Incorporated, Aviation Radio Sales, 110 Ionia Ave., N.W., Grand Rapids 2, Mich.

Light, comfortable headphones are included

Price includes carbon, press-to-talk aircraft-type microphone

Optional loop makes the PXer an efficient aural-null direction finder

LEAR RADIO

Lear INCORPORATED

completed by the Navy to prove conclusively the dependability of the system.

One of the difficulties originally experienced, both in the forward areas and in the states, was the logical problem that the secret and confidential nature of GCA during the wartime development period necessarily made it "little known" to the man who must use it—the pilot.

An example of this was the pilot of the *Superfortress* unable to land at Iwo Jima because of weather conditions. He had never heard of GCA and when it was explained to him over the radio he chose, instead, to attempt to land without it. Several passes over the field convinced him he could not find the runway—and Mt. Suribachi was a mental hazard looming somewhere out in that soup. When the effective ceiling was only 100 feet and the visibility less than a mile, the GCA crew took over. As this mobile Army GCA crew had worked only with *Black Widows*, a *Superfort* pilot was brought into the trailer for consultation. The stage was set for GCA's greatest test: rain, strong cross-winds, severe turbulence near Mt. Suribachi—the weather so bad that the pilot had to fly the rudder and the co-pilot the elevators. This alone made it extremely difficult in lining up the plane to follow the glide-path accurately. Finally the pilot called down to GCA: "Either get me down or shoot me down . . . there isn't any more gas."

GCA did bring in the big plane without shooting it down. A grateful plane crew wrote letters of thanks to all of the GCA crew. After that incident of April 4, 1945, *Superforts* landed regularly on Iwo Jima —as high as 20 in one day—until Japan finally called it quits last August.

At present it is difficult to predict how far GCA can go in the future. There have been numerous instances where pilots have been "talked down to touch," actually landing without any visual contact. At present, however, GCA is not claiming that Ground Controlled Approach actually can bring the plane down to touch—rather that it can be brought down during almost zero conditions with the pilot taking over visually 100 feet or so off the runway.

One serious difficulty with GCA is overcoming the problem of heavy rain. The sweeping radar beam strikes against the falling rain and is reflected back into the scope. The image of the rain appears white, as do all objects pictured in the scope. If the rain is heavy, it is that much whiter. The incoming plane is also white and it becomes difficult for the radar reader to trace the path of the white blip of the plane through the whiteness of the rain. This remains one of the most hazardous aspect of the entire GCA landing system.

When airports are equipped with radar landing scopes, commercial airlines will offer greatly improved transportation facilities. The excessive overhead caused by cancelled flights will be reduced. GCA will increase safety, dependability and economy—with resultant increases in air transport volume and relative reductions in costs.

Radar landings will also widen the scope of private flying. Instruments are cheaper and many of them are already standard with private planes. The "weather-permitting" basis on which private flying is conducted now will be greatly expanded. END

Wooden Wonder

(*Continued from page 52*)

happier. They all agreed that Kaiser could not make good his promise to create, in only 10 months, a flying boat larger than any yet built, much less follow through with almost immediate mass production. They felt that he could not do it even with the necessary materials and men. And there was the crux: Kaiser's resources, vast though they were, did not include either the brains or materials that create airplanes.

Kaiser's reputation in other war jobs, however, had given him a peculiar hold on public opinion. Lacking sufficient information upon which to make accurate judgments, the country was like an audience at a magic show, with Kaiser doing the tricks—anything seemed possible. Airplane manufacturers, on the other hand, were like ushers in the theater—they thought they already knew how all the tricks were performed.

Those were days when the average time for getting the prototype of a new plane into the air was a little more than four years. It took almost as long to develop an engine. And even after the first type was produced, so many faults usually showed up in flight tests that "bugs" became a term as common to the test crew as to the insect exterminator. To top all this, millions of dollars had to be tossed around like so many dimes.

But no one in Washington officialdom, whether in or out of the military, was willing to give Kaiser an abrupt "no." The chances of convincing the American people that Kaiser could not do what he proposed were slight, it was felt. It seemed safest to assume that the public would believe the aircraft industry was being protected or had somehow failed in its responsibility, and that Kaiser was being martyred.

There were many conferences and meetings. Finally, however, the Army and Navy refused to make appropriations for Kaiser since his project threatened to interfere with production schedules for combat planes. He was turned down by the Maritime Commission, too. Eventually, Kaiser obtained a letter from Donald Nelson, chairman of the WPB, promising some assistance with the understanding that Kaiser would not recruit designers from the established aircraft companies, draw upon existing stockpiles or resources already committed, or in any way interfere with the output of combat airplanes.

Meanwhile, Kaiser had exhibited some illustrations of large flying boats but had not shown any detailed engineering or production drawings needed for the building of an airplane and which require thousands of hours of work by highly skilled aerodynamicists and draftsmen. In the face of general scepticism, Kaiser said he could, if necessary, train his own technical staff and would find new sources of materials or utilize non-critical materials.

In August, Nelson appointed Glenn L. Martin, Grover Loening, John K. Northrop, and Donald W. Douglas as a committee to confer with Kaiser and appraise the possibilities in his scheme. The committee met August 24 in the office of Douglas, who had been named committee chairman.

Kaiser and several of his executives were present, and he disclosed that a day or two before he had made an arrangement with Howard Hughes, multi-millionaire racing pilot and owner of an experimental aircraft plant, to join him in his venture. During the discussion, Kaiser clashed several times with Douglas, whom he accused of being antagonistic. When the meeting ended the committee had failed to learn just what Kaiser intended to build and how he proposed to build it. Kaiser, although he had presented no definite plan, insisted that he wanted the committee to advise him what to do. This was not done. Finally, he announced that he was not getting the proper co-operation from the industry and that he would submit his eventual plans directly to a Government agency.

Shortly thereafter, the RFC, which had already loaned Kaiser $111,000,000 for a steel plant and $26,000,000 for a magnesium mill, allotted $18,000,000 for his airplane project. It was not a loan and no one has to repay it. The commitment was made, it was reported, by direction of President Roosevelt, and was handled as a contract with the Defense Plant Corporation for three airplanes, the first to be delivered in 10 months.

That fall, planning was started in the Hughes factory. Several months later, after numerous projects involving flying boats of various sizes had been explored and discarded, the decision was reached to build a 400,000-pound aircraft of wood. Work on the plane began early in 1943. Gradually, Kaiser faded out of the scene and in 1944 withdrew altogether. A new contract between Hughes and the RFC was signed in March, 1944, calling for the delivery of the one plane, ready for flight, at Culver City.

The difficulties expected in creating an airplane of such size were multiplied for Hughes because, due to a shortage of aluminum, he had to work in wood. Even the hangars in which the H-4 was fabricated were wood. The buildings, covering eight acres, an elaborate system of fire control, and other items ate up $6,000,000. The $18,000,000 committed by the RFC was all expended and Hughes is reported to have thrown in $2,000,000 of his own funds to complete the plane.

Wingspread of the H-4 is 320 feet, as compared with a *Superfortress's* spread of 141 feet. The fuselage is 220 feet long, 30 feet high, and 25 feet wide. This tremendous hull provides a cargo compartment 85 feet long, 20 feet wide, and 11 feet high, into which two freight cars

CONTINENTAL AIR LINES

"Record Efficiency depends on Superior Maintenance," says Continental Air Lines

SKY GIANTS! Long range planning of top airline executives is keyed to the extraordinary performance of Super Liners now being produced by several of America's leading manufacturers. Here Continental's President, Robert F. Six *(left)* inspects the C-97, wartime version the Boeing Stratocruiser. In the construction, as in the maintenance of such great aircraft, Snap-on tools play an important part.

"...and Snap-on tools have played an important part"

The swiftly mounting route mileage of Continental Air Lines now links nearly thirty strategic cities in six states . . . from Kansas City to Denver, Denver to San Antonio, and the newly inaugurated Tulsa-El Paso route. And, through nearly 12 years of exceptionally rapid growth, Continental has been a consistent safety award winner!

"Superior Maintenance" is Continental's answer. Superintendent of Maintenance Ray C. Johnson adds—"The efficiency and dependability of Snap-on tools has played a very important part in making it possible for Continental to average 98% schedule completion and to utilize each aircraft 4,000 hours per year".

Snap-on tool service is conveniently available through 38 factory branch warehouses in important aviation centers. Write today for complete Snap-on catalog of more than 3,000 tools.

SNAP-ON TOOLS CORPORATION
8024-D 28th AVENUE KENOSHA, WISCONSIN

would fit side-by-side. Below the cargo section are water-tight bulkheads separating 14 fuel tanks, each with a capacity of 1,000 gallons. With two thirds of the water-tight compartments punctured and flooded with water, the plane will still remain afloat.

The boat's total useful load is 152,000 pounds. (Useful load is the weight that may be divided between fuel and cargo.) Were all this capacity devoted to fuel, the H-4 would have a range of 5,900 miles. This would require special long-range tanks. Normal fuel load in the below decks tanks is considered to be 12,500 gallons. On this quantity it will carry a payload of 35 tons—slightly more than the entire weight of a four-engined *Skymaster*—a distance of 2,900 miles.

Eight of the largest engines available, 3,000-h.p. Pratt & Whitney *Wasp Majors*, are installed in the leading edge of the wing, with exhaust gases utilized for jet assistance. Top speed is estimated at 218 m.p.h., and cruise 175 m.p.h.

Aside from its wood structure, the H-4 is largely a conventional flying boat. In developing the design, Hughes' engineers worked with the National Advisory Committee for Aeronautics. A 1/16 scale model was tested in a tank at the NACA's LANGLEY FIELD laboratory and found to be equal in good water characteristics to any model ever tested there. The hull is exceptionally clean and graceful.

Extraordinary care was exercised in protecting all wood against deterioration from dampness. All gluing was done in buildings held at constant humidity and a temperature between 72° and 80°. Birch parts were made from veneer varying in thickness from 1/64 to 1/8 inch, laminated with glue. Most spruce parts were made from solid stock but the longeron billets, because of their great size, were laminated in 3/16-inch thicknesses. The billets measured 10 inches by 10 inches by 100 feet.

A virtually complete woodworking industry has grown up around the Hughes flying boat. Because of the great size of some parts, new techniques in wood handling were developed. Hughes secured a franchise to use the Duramold method of laminating and forming curved parts under pressure and heat. His autoclaves are among the world's largest.

There is no metal in the structural parts of the plane other than a few hinges and framing around windows in the pilot compartment. The cargo floor was designed to carry a load of 125 pounds on each square foot. Supporting frames were arranged so that by laying planks across them any heavy piece of equipment, including the Army's 60-ton tank, can roll under its own power into the huge loading doors in the nose.

The bottom skin is ½-inch thick. Because it is more flexible than metal, the designers say this wooden hull should be less liable to leaks and damage than the bottoms of conventional metal flying boats.

Any engine trouble can be repaired quickly because the wing is so thick that a man standing upright can walk inside the leading edge to the nacelles and make adjustments, even minor repairs, in flight.

The distance of the engines from the cockpit posed special problems in devising an engine control system whose great length would not prevent the sensitive reaction required for precise adjustments. Taking a leaf from the railroad book, the engineers adopted the same pneumatic system used in braking trains. The engineer's control adjustments are transmitted to the engines by compressed air. Electric motors do the compressing, but pressure bottles contain a sufficient supply to outlast a normal flight in the event of compressor failure.

PSYCHRONOMETER

FOR obtaining accurate in-flight data on humidity and temperature, an aircraft psychronometer has been developed by Camp Evans Signal Laboratory.

The instrument consists of wet- and dry-bulb thermometers, identical with the exception that the wet bulb thermometer has its tip wrapped in a damp muslin cloth. Calibrated portion of the tube may be read inside the fuselage of the plane, but the bulb extends into a ventilation duct. A careful study of all corrections involved, including that due to speed of air past the plane, has made it possible to determine accurately temperature and humidity.

Similarly, auxiliary power is used to operate the control surfaces—so great in area that no one could move them manually while in flight. The system is hydraulic and reversible in action, so that the pilot does not lose flying "feel." When gusts strike the surfaces, or reduced speed makes them move more easily, the pilot will know it. As a safety measure, each control surface is operated by two completely independent hydraulic systems.

Propellers are full-feathering, hydromatic, four-bladed, and 17 feet in diameter. The four inboard propellers have reversible-pitch blades for better maneuverability and braking on the water if required.

Take the skin of the H-4 as an example of the length to which the Hughes men were forced in innovation. It is quite likely that the H-4 is the first airplane to have its skin finished by ordinary paperhangers. After exhaustive tests to discover the finish most resistant to water damage, this formula was hit upon; a coat of wood filler, one coat of sealer to act as a cement for a thin tissue paper, two coats of spar varnish, and one coat of aluminized spar varnish. The paper-hangers applied the tissue. The result is a brilliant silver finish that rivals in smoothness the surface of any combat plane—even the glass-like skin of the Lockheed *Shooting Star*.

Completing the craft did not end the story. How to get it launched was a problem that required nearly a year of planning. The cheapest and most convenient plan, hauling it a few miles to the ocean and transporting it to a protected harbor by barge, was discarded because of the risk involved. A sudden storm might easily wreck it.

The only other alternative, and the one adopted, was to roll it overland 28 miles. This will require the moving of some 900 telephone and power lines owned by 23 utility companies. Hughes has signed a contract for the moving job with a company experienced in transporting heavy equipment. Special drydocks were planned so the H-4 could be assembled and launched without dangerous stresses, and for use in making any repairs required during the long period of flight testing. However, no appropriation for the moving expense, building of drydocks, flight testing, etc., has as yet been made. The additional amount required for these expenses is estimated at $2,000,000.

Although the DPC, owner of the flying boat, has announced no plans for it, it is assumed it will be used experimentally, under direction of the CAA, in much the same way the Army used its Douglas B-19 bomber.

While the Hughes engineers acknowledge that wood has certain advantages, in building any successor boats they would prefer to use metal because of its homogeneity. Metal stresses are more easily calculated and a great variety of materials have been developed for special purposes while wood is less easily managed.

However, before he resigned his position as general manager of Hughes Aircraft several months ago, C. H. Perelle stated that no other model will be built, either in wood or metal "because the ship has no practical purpose and the cost is prohibitive."

The H-4 cannot be licensed for passenger-carrying, since it was designed purely for cargo and does not comply with the CAA's requirements for civilian transports. It even lacks windows.

Speculation is widespread over the selection of a pilot to make the first flight in the world's largest airplane. Hughes, enigmatic as usual, has not indicated even to his own people whether he wants the job, although heretofore he invariably has been the first to fly his experimental planes. Since he does not own the plane, the decision will not rest with him alone, and the CAA, as advisor to the DPC, doubtless will exert heavy influence in the final choice. END

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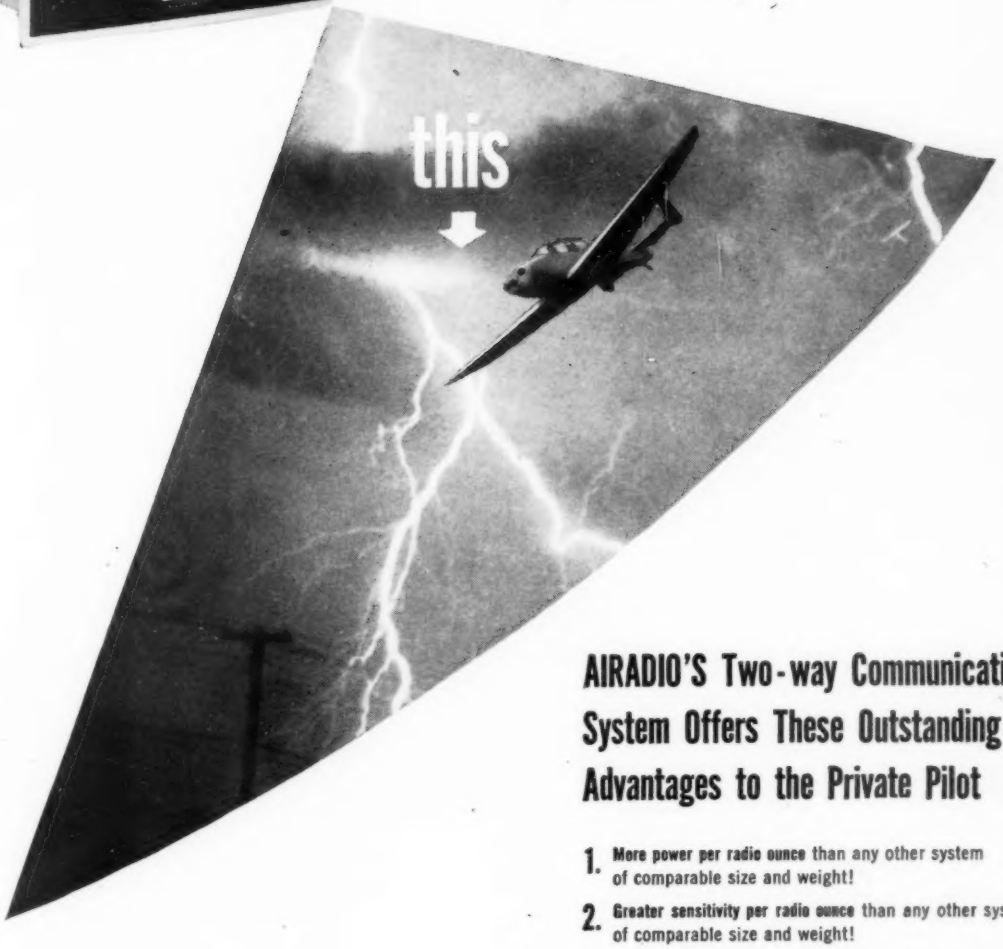
FEATHERWEIGHT RECEIVER

can prevent



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Pacific Rescue

(*Continued from page 38*)

jeep carrier that was to figure prominently in the adventure. Launched as the CVE-61 in October, 1943, she had done more than her part in both the Atlantic and Pacific. She had been on active combat duty from launching to V-J Day, had fought through the campaign for the liberation of the Philippines and had taken a *Kamikaze* against her island structure in January, 1945. Twenty Jap flags painted on her bridge spoke of the marksmanship of the pilots who flew from her deck and the crew who manned her guns.

Now the carrier was on the "Magic Carpet" detail. Less imaginative crew members called it the "slave trade". Her hangar deck had rows of steel bunks instead of airplanes and her job was returning veterans to their homes. On this night, when Capt. S. E. Robbins of Palo Alto, Calif., was setting his *Clipper* safely down at sea, the *Manila Bay* was steaming for Pearl Harbor. The two were just 60 miles apart.

First inkling of the *Clipper's* plight came to me at 6:30 a.m. Our executive officer, Comdr. W. R. Macdonald, flicked the light on in my room saying, "Ralph, there's a *Clipper* down at sea about 60 miles from us. It looks like we'll have to spend some time picking up survivors. . . . Maybe we can even save the plane."

As I rubbed sleep from my eyes I told him I'd meet him for coffee in the wardroom in 10 minutes. On my way down I awakened Lieut. John F. Watson, assistant air officer, and asked him to get a crew of men together and briefly told him what the exec had said about salvaging the plane.

Word of anything unusual gets around a ship quickly. By the time we had downed our coffee and had gone topside, the ship was bustling with activity. Her two small whaleboats were made ready, so they could be slid into the water as soon as the airplane was sighted. By this time we had learned some more details by radio. The *S. S. John Henry Payne*, a freighter enroute to San Francisco, had sighted the flares dropped by the *Clipper* before her landing. She had taken aboard all passengers and was standing by awaiting our arrival. The general message alerting all ships between Hawaii and the mainland had been narrowed down to us—we were directed to take charge and effect rescue and salvage.

An hour later we were close enough for Capt. Leon Johnson, skipper of the *Manila Bay*, to order the whaleboats lowered. I was in one of them with a crew of four men and Lieut. "Watty" Watson skippered the other. I went directly to the *Payne* to take on the passengers, but found only one—Lieut. Comdr. E. F. Barrett—who wished to accept the *Manila Bay's* hospitality. The others were homeward-bound Naval officers who wanted to keep going on their original course, even if at a slower pace. Lieut. Comdr. Barrett was due in San Pedro to report to a ship on November 10 and would never make it on the freighter.

Watson's boat went to the airplane. He could see her name, *Honolulu Clipper*, on the bow. Inside were 10 crew members who had spent 10 hours in a pitching, rocking plane. Eight of them—all save Dunbar Carpenter, second co-pilot, and Jack B. Crawford, radio officer—came on the whaleboat and returned to the *Manila Bay*. Carpenter and Crawford stayed aboard for nearly five hours longer.

The operation of taking men off the *Clipper* proved ticklish. Even a small whaleboat could not come close to the airplane lest a swell dash it against the structure, make a hole and sink the plane. The transfer, therefore, was made by rubber life raft. A line was thrown and made fast to the whaleboat which stood off about 100 feet. The other end of the line was attached to the sea wing of the *Clipper*. One man in the rubber boat then inched his way back and forth from the airplane to the whaleboat with a cargo of survivors. The sea was relatively calm, but in the open the calmest sea runs in swells which made the trips of the raft more than interesting.

When we were back on the *Manila Bay*, First Engineer Dan W. Broadwater of the *Clipper* went into a huddle with Chief Boatswain Morris Applebaum of our carrier to devise some sort of tow line to save the *Clipper*. "I love her like a sister," he exclaimed, "and I'm going to do everything I can to save her."

Honolulu Clipper was the first Pan American World Airways plane to go down with passengers in an open sea. No one had ever had to save a *Clipper* before. It was impossible to lift a 25-ton flying boat onto the flight deck of a baby flat top—even if the deck would hold it once there, which it wouldn't. Our boom was designed to lift only 17 tons. However, ahead of us was a virtually undamaged airplane which we wanted to save. There was only one way to do it—tow it behind the carrier—and we were nearly 700 miles from Hawaii.

Dan Broadwater had carefully saved the plane's engineering manual in an oil skin. He was able to show Bos'n Applebaum some of the things about the *Clipper* he had to know—its weight, how it rode in the water and, most important of all, the strength of a pendant attached to the bow. This pendant was put there to allow the *Clipper* to be towed in the relatively calm waters of the harbors in which she landed and took off. The pendant, the manual said, was fixed under the water line of the bow, about three feet aft the nose. It was about 15 feet long and the end was carried in a groove to the topside of the nose where it was held in place for easy access. That's what the manual said; we were to learn differently.

Since it was impossible to put a diver in the water to attach any other sort of line direct to the *Clipper*, this pendant would have to suffice. It was apparent that any strain which would be likely to break the pendant would, if attached to a stronger line, pull out a chunk of the nose of the airplane. So the pendant would have to do.

It was decided to attach a cable from the *Clipper's* pendant to a point about 75 feet forward of the nose. Two other lines would angle back to the airplane from this point and be attached to the propeller hubs of the two outboard engines. These lines would serve to keep the wings of the *Clipper* more or less steady but would not, in themselves, assume any strain. That would all be transmitted direct from the airplane via the pendant to the cable, then to a six-inch hawser from the ship which in turn would be shackled to the cable at the point where the three lines met in front of the airplane's nose.

All this gear—cables, ropes, shackles and the tools necessary—was put into one of the small whaleboats.

Into the boat, besides Lieutenant Watson and myself, went First Engineer Dan Broadwater and his assistant, Robert J. Dernberger. Dernberger had been seasick all night in the airplane and it took guts for him to venture back into a small boat. Then three enlisted men from the *Manila Bay* eased in—ACMM W. E. Howe, AM1/c R. R. Bisbee and AMM 3/c P. Antos. Seven men plus three crew members of the whaleboat. There would

The GOLDFISH CLUB

The Goldfish Club was formed in order to give recognition to the thousands of pilots and aircrewmen who have ditched their aircraft or bailed out at sea and have saved their lives through the use of life jackets or dinghies. Army, Navy and Civil Air Patrol personnel are eligible for membership. To apply, the following information should be submitted to the American Secretary, Max Karant, Managing Editor, FLYING, 185 North Wabash Avenue, Chicago 1, Illinois:

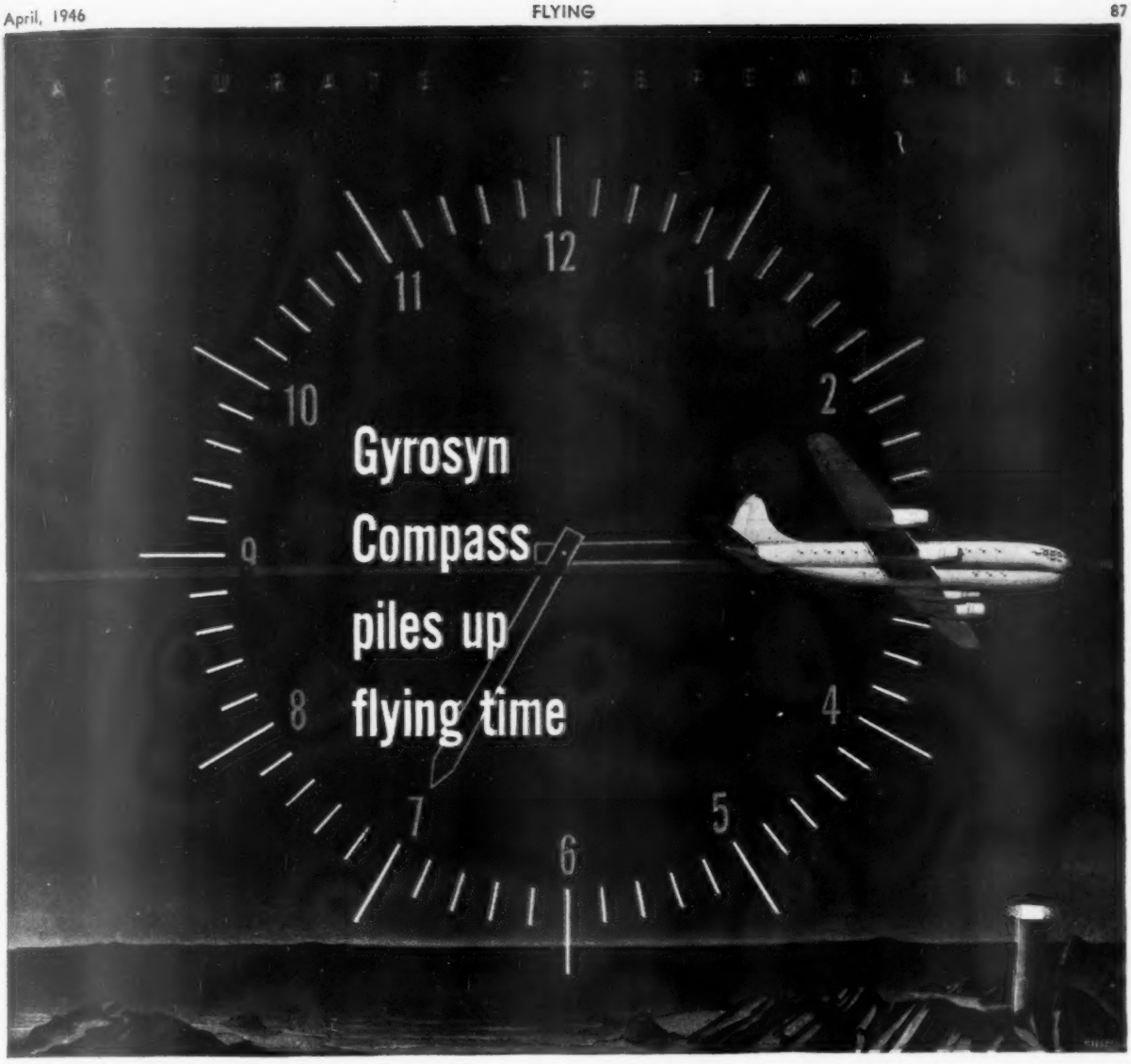
1. Name, rank and serial number
2. Service address
3. Home address
4. Date and location of incident
5. Description of incident
6. Signature of applicant
7. Signature of commanding officer

The No. 1 Goldfish Club card was presented to Ens. George Gay, sole surviving member of the famed Torpedo Squadron Eight. The award was made on January 14 at a FLYING luncheon attended by some 25 club members from Chicago and surrounding suburbs. Ensign Gay, who ditched his plane on June 4, 1942, during the Battle of Midway, was chosen to receive the No. 1 card in honor of the 14 officers and 15 enlisted men of Squadron Eight who did not come back from that battle.

A listing of the Club members, a regular feature in preceding issues, is continued below:

126. Shakespeare, Fredrick S., N
127. Lucas, William S., N
128. Donaldson, George P., N
129. Ashcraft, James E., N
130. Merrill, Earl H., N
131. White, Dillon E., N
132. Wendleton, James D., N
133. Moore, George, N
134. Maracek, Milan, A
135. Eastman, Harold Jr., A
136. De Feo, Lawrence P., A
137. Kohlman, Cornelius, A
138. Fain, Sam N., A
139. Huchingson, Ernest M., A
140. Bouchek, George, A

A—Army; N—Navy.



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also be two more crew members from the *Clipper* to return with us. With the gear, it was a capacity load which now set out hopefully for the *Honolulu Clipper*.

We were old hands by this time at handling the line from the *Clipper* to our whaleboat so the transfer of men and equipment was made without incident. Those of us who remained in the whaleboat, three crew members and I, had a ringside seat to the harnessing of the gigantic airplane. First to be attached were the two lines on either outboard engine. Then we went for the pendant. It apparently had come loose in the landing the night before and now hung deep in the water, completely out of reach. The nose door was opened on the port side and Dernberger leaned out with a hook attempting to grapple it. The sea was crystal clear and the line could be seen dangling below the airplane but no matter how carefully Dernberger fished, it remained tantalizingly out of reach.

There was no alternative but to bring the rubber boat alongside the nose and probe for the pendant from there. The airplane was tossing so violently that we had visions of the rubber boat coming so close that the nose would catch it and throw all hands into the sea. This danger was averted by holding the boat away from the airplane with a 10-foot pole. Even so, it was ticklish business, for the swells were now running five feet and more. The pendant was retrieved finally and everyone breathed easier.

Shackling the pendant to the cable was accomplished on the bow of the airplane with Broadwater sitting atop the nose and doing the job. Together with the two lines from the outboard engines, the cable was then gently put into the rubber boat and coaxed out to the whaleboat. We attached a small sea anchor to each of the side lines so they would ride low in the water, then did our best to approximate the correct length so that each would come together at the right point.

By this time the second whaleboat had set out from the *Manila Bay* with the six-inch hawser. This had previously been attached to a winch on the fan tail of the ship and was 200 fathoms (1,200 feet) long. So that the shackling could be done without losing any of the lines, each was secured firmly to the bow of the whaleboat. In effect, the whaleboat was now harnessed to both the *Clipper* and the ship. There was no peril in this situation—until the *Manila Bay* got under way slowly to take up the slack in the hawser. We were caught like a twig around which a line had been twisted, with something on either end pulling like the very devil. To make matters worse, the airplane's battery elected to go dead at this point and our communication with the ship died with it. Our boat could have been swamped and would have been if Captain Johnson had not kept close check on us with his glasses. He saw our frantic wavings and came to a stop.

This minor crisis served to speed those who were engaged in shackling the various lines and in a twinkling the job was finished. We tossed the lines over the side of the whaleboat glad to be free of the things.

Before we could leave the *Clipper* some repair work had to be done. Apparently in landing, a four-inch hole had been stove in the tip of the port sea wing. This was taking in a good deal of water—enough to be serious if not stopped. Bisbee, our aviation metalsmith, had been brought along to do this work. Flat on his belly on the sea wing, he worked with drill, metal and glue. As the airplane rocked sideways the wing would become completely awash. But Bisbee stuck to his job even though it meant he was under water half the time.

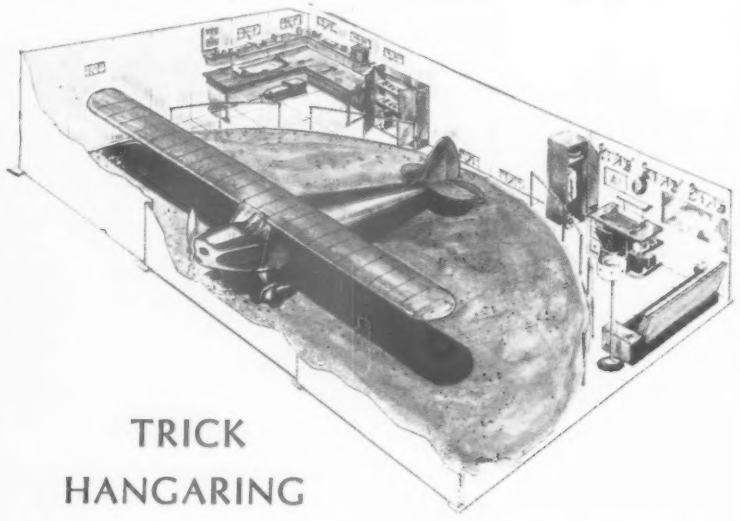
In order to take on the men still on the *Clipper* and complete the work which had now consumed nearly three hours, it was necessary to go around the starboard side of the airplane and approach the port sea wing from the stern. The *Clipper's* nose was pointed into the wind, so this made our approach from the downwind side. The *Clipper* looked big as it drifted toward us when we were astern and we lost no time in getting a line aboard for the rubber boat. Unfortunately, after only one trip the line broke. Dunbar Carpenter, second pilot of the airplane, was skipper of the rubber boat at the time and he found himself drifting under the tail of the airplane around to its starboard. He couldn't get away because one end of the line was still attached to the airplane which was vigorously pitching in the swells—they were now up to 10 feet—and the entire tail at times would be completely under water. If Carpenter had been caught under the tail when it was coming down he would have been killed.

To save him it was necessary for our whaleboat to come closer to the airplane than we had dared heretofore, even when the swells were not running so steep. We, too, could be swamped by the angrily pitching airplane but we made it, thanks to some expert maneuvering by the coxswain.

This time we had to work closer to the airplane because of the shortened line. We were also downwind and the flying boat drifted toward us with frightening speed. The transfer of the men aboard was safely accomplished and we set out for the return trip to the ship.

Back on board we reported our part of the mission accomplished, then went to the fan tail to see the results.

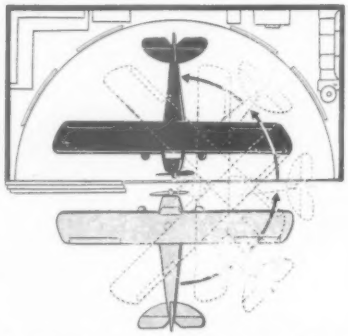
Captain Johnson gave the order for ⅓ speed ahead and gradually the airplane



TRICK HANGARING

AN ALL-STEEL prefabricated hangar which markets for $1,000 has been devised for private pilots by the Universal Corp., of Dallas, Tex. Its most novel feature is the elimination of long trusses required in conventional structures through use of an old trick in hangaring.

It has always been a hazard to open the large doors of conventional hangars in high winds. It became the practice, therefore, to open these doors under such conditions only as wide as the plane fuselage was long. The airplane was then drawn up to the hangar nose first and angled inside. By adopting this same method of hangaring and thus reducing door widths, the Universal Corp. has brought production costs on its new hangar down some 50 per cent. The hangars are large enough for a lightplane and provide space for a workbench and a small dressing room.



got under way. The speed of the ship was eased to six knots and for the next several hours everything went beautifully. The airplane insisted on turning slightly to the left of our course in an effort to keep its nose into the wind, but otherwise there was no trouble.

Just before sunset the lookout reported that the port line seemed to have broken. Together with Captain Johnson I looked at it carefully through glasses. There seemed to be no doubt; the line trailed aft of the airplane. But our *Clipper* was still riding easily.

At 7:30, an hour after darkness had fallen, word came down that the tow line itself had unquestionably broken, but there was no help for the *Clipper* at this time. After Captain Johnson had reported the break in the tow line we were ordered by radio to stand by and attempt further salvage the next morning. We were also notified that the seaplane tender, *U.S.S. San Pablo*, was leaving Pearl Harbor to continue the work of salvage. We were to keep the airplane in sight until the *San Pablo* arrived, sometime Tuesday. This was Sunday night.

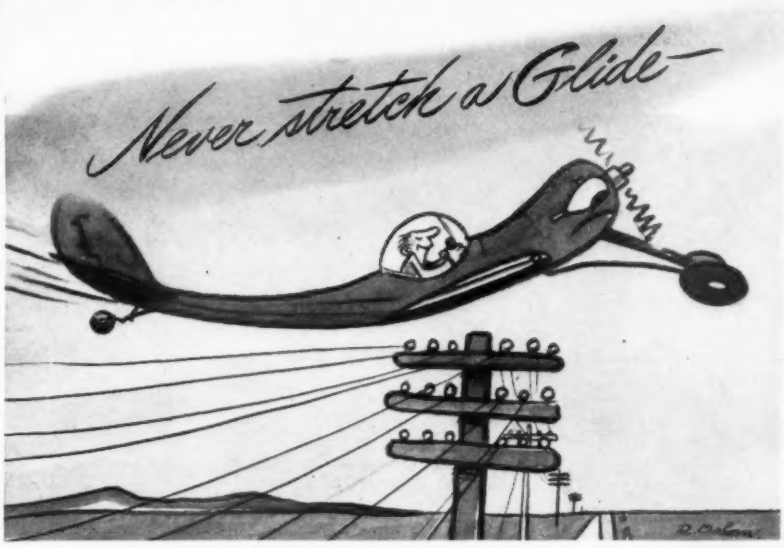
Next morning a tired, aching group of men set out for the *Clipper*. This time the sky was overcast, a fresh wind of nearly 18 knots was blowing and some dense rain showers surrounded the scene of action. The sea was running in great swells that made the prospects even gloomier.

We skirted the *Clipper* much as would a fox terrier after a bear, being especially careful not to allow ourselves to be drawn against the side in a swell. It was obvious that no salvage or further towing could be accomplished unless a swimmer —and a very good one at that—would do the work close in. This word was wigwagged to Captain Johnson on the *Manila Bay* by a signalman. Captain Johnson ordered us to return; he felt the risk too great to attempt.

For the remainder of that day, Monday, and until 12:30 the next, the *Clipper* drifted slowly with us in the sea. At night it would get completely out of sight; once it was eight miles away. Through radar the airplane's position was always known to us.

The proper end to this adventure would have been for the *Clipper* to be brought safely into berth at Honolulu. But such was not to come about. The *U.S.S. San Pablo* rendezvoused with us at the appointed time on Tuesday and we got under way immediately on our course to Pearl Harbor. Later, word came that the *San Pablo* had boldly attempted to do her work close in in heavy seas. The *Clipper* was washed against her side and tore off a wing. Permission was granted to sink it by gunfire.

Looking back, however, it was not such a bad ending. Not a person on the *Clipper* suffered from more than a case of seasickness. The *Clipper* proved it could take all the sea could offer in the 72 hours of its trial in the open Pacific—a test which her builders had not dreamed necessary when they launched her seven years before. The Navy's air-sea rescue team had once more proved its ability to search out and rescue the victims of a mishap at sea. END



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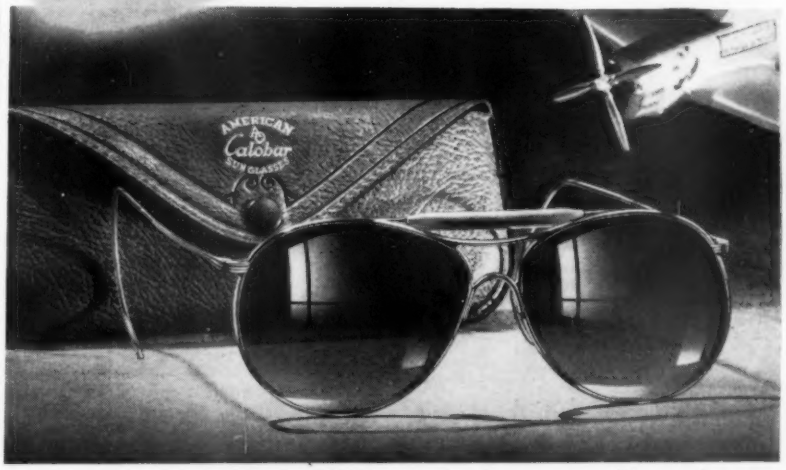

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Any Hope For the Private Plane?

(Continued from page 21)

Airplane Owners and Pilots Association to Joseph T. Geuting, Jr., manager of the Aircraft Industries Association's Personal Aircraft Council, representing most of the major lightplane manufacturers.

"Improvement in cockpit construction and visibility," says Mr. Geuting, "is being undertaken in connection with the program on crash injuries sponsored by the National Research Council Committee on Aviation Medicine." Work is also under way, he stated, to improve directional stability on the ground, reduce stall and spin accident hazards, improve controls and accessibility for maintenance, establish stricter requirements for inflammable materials, and reduce aircraft failures due to poor fuel systems.

"We are as much interested in improving aircraft and aircraft safety and utility, as well as the fun of flying, as you are," Mr. Geuting concluded.

Now, let's look at the record and review recent activities of CAA, NACA and the industry. Before the war ended, all responsible parties were making tentative plans for peace-time research. NACA took steps to reconvert the moment hostilities ceased. Early last fall, CAA published details of its proposed research program, with emphasis on personal aircraft. The industry, without revealing any trade secrets, implied by everything it said that revolutionary changes would be the keynote of post-war lightplane design.

The three groups went farther. Under the aegis of NACA, a special survey of the industry was made during the fall. Grover Loening, outstanding authority in aeronautical research in all its branches, toured the nation to do this job. Following his report, NACA called together John W. Crowley, its acting director of aeronautical research; T. P. Wright, Administrator of Civil Aeronautics; John Geisse, CAA Assistant to the Administrator for Personal Flying Development and a lifetime crusader for lightplane improvements, and other experts. The purpose of the meeting was to co-ordinate any work that might be undertaken. First step was to query the industry on its preference as to what direction the research should take. As this appears in print, another meeting is scheduled which will attempt to analyze the industry's reactions.

So much for the surface facts, all of which point in the right direction. But behind these facts are others indicating that research in the lightplane field is everybody's step-child and seems destined to remain nobody's responsibility for some time to come. Here are some of them:

The Loening report said, in essence, that the industry was completely indifferent to research at this time.

It follows that querying the industry by the NACA-led group on what research is desired was a waste of time, if not a stall.

Spokesmen for NACA will tell you off the record that, actually, practically nothing has been done to convert to peacetime work. Post-war demands of the Army and Navy, especially in the field of supersonic speeds, is gobbling up all available funds. If any crumbs fall from the table they will be used on transport research because transport designers have expressed real interest—in contrast to the indifference of the lightplane builders. Lightplanes are, therefore, a poor third in the NACA program. Besides, NACA is understaffed and some of its best people, now that the war is over and there is no high priority on their work, are being drafted. It is said, also, that there is little pure research left to do on lightplanes!

PLANE SAVER

A RADIO-CONTROLLED Navy target plane is borne earthward by a new-type parachute, design of which includes a shock-absorbing hem cord. Action of this device causes a gradual inflation of the canopy rather than the instantaneous and explosive characteristics of the ordinary parachute.

If experiments prove successful, this parachute could become a permanent piece of equipment for private planes. The parachute would be packed in a container which would require official inspection and repacking only once in two or three years.

The CAA is willing and eager to get to work and vitally aware of the need for research. Peace had hardly been declared before the Administration, backed by Secretary of Commerce Henry A. Wallace, proposed a million-dollar research program on the grounds that private industry could not do the work because one man's development is usually something the competition can profit by without cost, and because it is hard to overcome sales resistance to an innovation. Among other things, CAA proposed a study of propeller and exhaust noises and methods of reducing them, further simplification of controls, high-lift devices, and cheaper engines.

To get the money, CAA had to clear through the Bureau of the Budget, which knocked the million-dollar proposal on the head, leaving the Administration with $150,000 earmarked for experimentation with cross-wind landing gear. There is no sign of further funds being approved by the Budget, and the CAA development enthusiasts are left with no place to turn except to the NACA—or the industry.

To turn to the latter—despite official statements from Aviation Industries Association, individual aircraft manufacturers, or highly optimistic distributors—would at this point be the height of futility. The Loening report is the pay-off—the industry is uninterested in research. An independent, eye-witness, manufacturer-by-manufacturer survey by AOPA checks and double-checks this fact. Plane by plane, the trend is inescapable—planes are going to be expensive, standard, and with as few improvements of any kind as possible. Radically new designs—or even old ones with the bugs taken out—are as scarce as hen's teeth, and the general industry attitude is that there are a hatful of orders waiting this year for the guy who gets there "fustest with the mostest" planes, regardless of design. Therefore, build 'em and sell 'em. Thoughtful development of a mass market and the advancement of aviation will simply have to wait.

It is an understandable bird-in-the-hand attitude and one that cannot be shouted down by pleas for sacrifices for dear old aeronautics. But with no research whatsoever on the horizon, it does not bode well for aviation once the current backlog of orders is caught up with and the public begins to look for what it wants in an airplane instead of being forced to take what the industry seems determined to give it.

The AOPA survey found lightplane manufacturers uninterested even in bringing the prices down.

"It is impossible to create a $1,000 airplane under present circumstances," two leading lightplane manufacturers stated flatly.

"We're too busy getting set to meet current orders to be bothered with research or improvements at this time," was another typical statement.

With NACA and CAA doing practically nothing, and industry doing less, it would seem that chances for the dream airplane of the bright new post-war world are little short of nil. Yet the situation is not hopeless. Agencies to do the work exist. The problem is to get them to do it.

The attitude of the aviation industry is human and understandable. It is being paralleled by the attitude of other industries from coast to coast—get out the pre-war models to meet the demand and then shoot for something new. But whereas there is a known and established demand for automatic refrigeration, radios, and automobiles, designs for all of which had been improved to meet public wishes before the war, the aviation industry is up against an unknown market and is the first to realize that it must meet it more

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than half way to get mass sales and a profitable number of resales. Research is a basic route to such a goal. And while everybody in aviation today is too busy to do anything about it, nobody denies the eventual need of improvements, which presupposes active work in the field immediately.

How this shall be done is the question and perhaps the best answer to date comes from L. P. Sharples, chairman, AOPA's executive committee, in a hitherto unpublished letter to NACA.

"The stupendous developments made in military aviation during the war years were so outstanding," Mr. Sharples points out, "that they accentuate the lack of development in small planes during the past eight years. This isn't because development isn't needed. Lightplanes have been fairly suitable for a pilot's first few years when he flies mainly for thrilling enjoyment. But when that wears off these planes do not provide the utility, comfort and safety necessary to retain the customer's interest. The purpose of this letter is to urge that NACA adopt such measures as are necessary now to stimulate and create similar advanced development of lightplanes."

Stating that Congress is appropriating millions for small landing fields, Mr. Sharples suggests that "a small per cent of this amount could well be spent to develop suitable planes to use these fields.

"NACA appears to be the logical agency to head up the development work here proposed," he states. "I hesitate to suggest a dream plane which might be set up as a goal for the first effort, since each person will have his own ideas. But to stimulate activity, my idea would be a four-place cabin plane with 200-m.p.h. cruising speed, 35-m.p.h. landing speed, able to land in a minimum field now usable by lightplanes, vibrationless and silent as an automobile for passengers, priced like an automobile, suitable for night flying and flying over overcast, quiet enough to keep peace with the neighbors, and twice as safe as the best two-control job now in production."

Mr. Sharples also favors a separate project to reach comparable goals for an amphibian. More specifically, he favors projects designed to reach the over-all goal. He lists 18 of these:

1. Cheap, lightweight, blind-landing apparatus suitable for night landings regularly and blind landings in emergency.
2. Light, high-powered landing lights for emergency night landings.
3. Self-flood lighting of planes so that they are more easily visible at night.
4. Cheap appliances for small fields to permit night landing regularly and blind landings in emergency.
5. Cheap, light radar suitable to avoid collisions.
6. Wing design permitting 200 m.p.h. cruising, 35 m.p.h. landing.
7. 150-h.p. engine weighing not more than 150 pounds.
8. Low-h.p. gas turbine.
9. Elimination of noise from propeller and engine without lowering efficiency.
10. Scientifically comfortable seats for lightplanes.
11. Means for reducing vibration and noise inside plane.
12. Landing gear suitable for slow-speed, cross-wind landing.
13. Amphibian with engine in the hull.
14. Amphibian with no more drag than land plane.
15. Designs and appliances that will minimize personal injury in case of crash.
16. System of running on low-flash fuel even though higher flash is needed for starting.
17. Light, cheap cartridge starter for small engines.
18. Leak-proof storage battery of lighter weight.

As Mr. Sharples has pointed out, everyone in aviation will have different ideas. But the point of the letter is that there still is research to be done and that NACA can, if it will, get work going in the lightplane field. It is perhaps the most urgently needed research in our post-war economy, not only as a vehicle to future prosperity but as a valued link in our defense. It deserves the backing of the industry and of everyone who flies or wants to fly in the United States.

And it deserves immediate action. We must quit talking a great game and begin playing one. Even then, it will be a miracle if we develop personal aircraft quickly and efficiently enough to meet public enthusiasm before it is dampened to distinterest by models now coming off the line. END

Naval Aviation Tomorrow

(*Continued from page 22*)

vice. *Gargoyle*, also jet-propelled, packs a 1,000-pound armor-piercing bomb which, when released, automatically seeks and collides with a ship target.

Successful demonstrations of pilotless aircraft had been made as long ago as 1940 when a torpedo plane, controlled by radio and directed by television from an aircraft 10 miles distant, launched its torpedo squarely into a maneuvering destroyer. In another experiment a dive bomber, operated by remote control, plunged through the center of a moving target. Subsequently, several types of assault drones were developed, a number of which were used against the Japanese base at Rabaul.

Use of pilotless aircraft also has been important in advancing the design of piloted planes. Ability to transmit test data to a control station on the ground or to another plane has enabled test engineers to obtain data under flight conditions which would be impossible in a wind tunnel and at speeds approaching those which would be expected to produce structural failure or injury to the pilot.

Electronics will play a major role in any war of the future. Pilotless aircraft will be controlled electronically and electronic "brains" will guide counter-missiles designed to combat the aircraft. Man will be much too slow for the new type of warfare but his mind can devise the weapons for defense.

Naval aviation will lean heavily on electronics for offensive and defensive weapons. The Bureau of Aeronautics, which has the responsibility for research and development in the aviation field, will have the assistance of the Navy's new Office of Research and Inventions, which already has expanded the airborne electronic facilities at the Naval Research Laboratory. Approximately one quarter of the skill and resources of this eminent scientific and technical center will be devoted to the electronic requirements of Naval Aviation.

At the end of the war, the Navy had perfected electronic listening devices which could be dropped from aircraft. Prowling enemy submarines, however, eventually were able to listen electronically for searching aircraft, but then the Navy confused the "pigboat" boys. It retaliated with a tricky radar gadget which convinced the submarine that the approaching airplane was going away. This often resulted in great embarrassment to the sub and its crew.

Nazi submarines countered with underwater intake valves—the "Schnorkel"—which enabled them to submerge for much longer periods. But the Navy increased the sensitivity of its radar to detect even this small object.

Many Navy aircraft now are equipped with complete electronic systems for searching out and identifying targets, bombing through darkness and nullifying the enemy's radio and radar. A Navy search plane, for instance, carries more than 25 items of electronic equipment weighing almost a ton.

The Japs and the Nazis also used electronics extensively. The Japs frequently opposed our air raids with searchlights and antiaircraft fire controlled by radar. In turn we developed counter-measures. Special radar jamming equipment bewildered the Japs. They would shut down their radar for a trouble check and, before they discovered what happened, Navy planes had put a Nip airfield or factory out of business.

Navy pilots, utilizing new electronic devices, rapidly learned to "home" on their carrier, to use the radar altimeter for safe approaches and low flying, and to identify friend or foe. They were able to attack shipping and shore installations through complete overcast with rockets, bombs or torpedoes.

Night fighting is another field in which the Navy pioneered. Midway in the war we already were producing the only single-place night fighters. The ingenious night fighter radar maintains a search over a large sector of the forward sky. Picking up any enemy plane at five miles, the pilot is able to close and direct gunfire with deadly accuracy at his unseen enemy.

Results of the night carrier operations were apparent in the Okinawa campaign when 91 enemy aircraft were splashed by

Navy night fighters in a nine-week period.

Early in the war the Navy introduced another innovation in aircraft communications. It moved out of the customary long waves into ultra-high frequencies which the Japs never entered. There our Navy flyers enjoyed privacy.

Another outstanding device is the radar corner reflector, developed for the long-range detection of tiny life rafts whose occupants otherwise probably would be lost.

The Navy is making great strides in the aircraft armament field to keep pace with developments in engineering and design. Armament gives the plane its fighting punch and includes such varied items as guns, rockets, bombs, torpedoes, mines, fire control, turrets, protective armor and smoke screens. The Bureau of Ordnance designs most of these weapons and the Bureau of Aeronautics installs them. The latter bureau designs its own armor, rack-launching gear and aircraft turrets.

The turrets, first installed in 1940, represent an outstanding accomplishment. They will be developed to utilize new guns and rockets, especially unmanned turrets controlled from a central fire control station.

We will improve protective armor for our planes. The use of material other than steel is also under study. Emphasis will be placed on protection against fragmentation, since the use of proximity fuses increases the danger from antiaircraft fire.

The .50-caliber gun is generally acknowledged to be the best aircraft gun in the business. Although we are making continual refinements on it, the eventual need for a better weapon is anticipated. Larger caliber guns are under development; guns with no recoil and of smooth bore design have great possibilities. The structural weight of our aircraft, necessitated by the current type of guns, could be considerably reduced with the new type of firepower. Ammunition systems, case and link ejection and adjustable mounts will be improved as well.

The aircraft rocket, which quickly became a weapon of major importance in this war, has tremendous possibilities which we hope to exploit more fully.

The high degree of efficiency with which our carriers operated in the Pacific war was dependent in great measure upon the use of catapults. On the relatively slow escort carriers (CVE), the catapult enabled us to keep heavily-loaded bombers in the air almost perpetually and may even have meant the difference between victory and defeat in the battle with the German U-boats.

Mechanical launching probably will be used for pilotless aircraft in the future and improved equipment is a vital necessity. Navy researchers will explore new and radically different mechanical processes and various types of energy sources in this field.

One of the greatest factors contributing to the high morale of our pilots is the Navy tradition that the recovery of a downed flyer is worth practically any risk. Navy pilots are not expendable and future plans call for improved equipment

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further to insure the air crew's safety.

In conjunction with this safety program, research also is proceeding in new methods for protection of fuel and oil systems.

The Navy pioneered in the use of light alloys for the construction of airplanes and we do not propose to relax our leadership in this field. We are looking for alloys with lighter weight, greater strength and higher resistance to corrosion. Improved fabricating processes are under investigation, too. Another project is research in heat-resistant alloys, which are necessary to the efficiency and increased life span of engines operating on the jet principle. The extremely high temperatures generated by jet engines eventually may result in the development of entirely new metals.

The Navy's special devices division, conceived just before Pearl Harbor as a new scientific approach to education, develops synthetic methods and equipment for training Navy men in gunnery, radio, radar, recognition, aerial bombardment, flight, navigation, air crew co-operation, maintenance, engine operation, antiaircraft and antisubmarine warfare.

In general, the effort of the special devices division is directed to solving problems presented by the continuous development of new and complex equipment. This department's ingenious devices will continue to provide the best training in the world for personnel of Naval aviation—the better the training, the better the chances of survival and the greater the economy of equipment and effort.

Aerial photography is keeping pace with the rest of the aviation field. Photo intelligence played an important part in determining the Navy's war strategy. It is impossible to predict the future ceiling of air reconnaissance but we may expect good pictures from much higher altitudes within the next few years.

Many photographic problems must be solved first, of course. Increased aircraft speeds will demand new materials, equipment and technique. Some of these requirements already are in the practical stage and progress is being made in higher resolution, longer focal length cameras, anti-vibration, stabilized mounts and extremely sensitive film.

The strip (continuous film) camera has made possible clear photographs of long paths of terrain and the stereostrip camera has made possible stereoscopic viewing and actual depth and height measurements with considerable accuracy. Further developments in this direction are in sight, promising highly accurate determination of depths and heights of terrain.

With ever-increasing emphasis on air power and safe air transportation, aerology will continue to play an important part in aviation. Improved aerological instruments and facilities offer many interesting peacetime possibilities. The problem of transmitting a ready-made weather map has long been under consideration. The time spent in entering weather reports on maps at a multitude of stations is prohibitive from the standpoint of wasted manpower.

A weather map prepared at some central radio station and transmitted via radiophoto is entirely feasible. The transmitted photo would provide a complete picture of the distribution of the weather over any given area. The inherent difficulties in such a procedure have been overcome and it is expected that the remaining technical problems will be solved soon.

Another possibility, now under investigation, is the application of rockets to the problem of obtaining weather data at extreme heights above the surface of the earth. Since the "ceiling" of man's activities in the atmosphere is continually rising, weather data will be required for heights up to 100,000 or 125,000 feet. The rocket may be the answer. END

Pilot Error Sense

(*Continued from page 48*)

"Why you Klunk! The *%X&#ing thing is caged! You couldn't budge it with a snap roll."

This is only one incident that shows how to make Klunk. There are many misuses of instruments that can qualify you and you are at liberty to select the one that's most becoming. Don't try to be outstanding by failing to heed your gas gauge, however. Any sap can do that and most saps do. In fact, it happens so frequently that the crash board just says, "Ho hum," and tells Western Union to send another telegram beginning, "We regret to inform you, etc., etc."

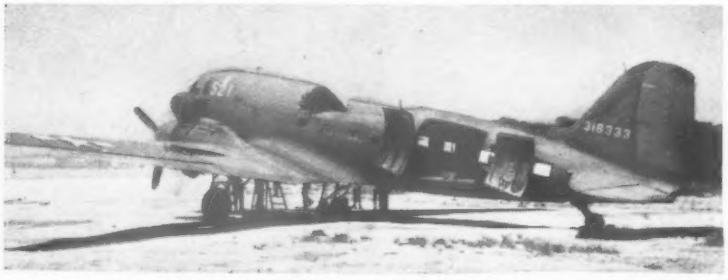
A similar rate is that of Goon, which you get by over-rating your memory and getting too old and wise and experienced to bother with the check-off list. Among the people who have never made Goon are the Marine and Navy pilots you read about in the newspapers—the flyers who killed Japs. It seems they always used their check-off lists . . . no self-confidence.

But if you want to make your mark in Naval aviation history—and in the dirt beyond the end of the runway—just skip the check-off list and make Goon. It leads to wonderful adventures, such as wheels-up landings, engines cutting out, putting down the diving flaps instead of the landing flaps on *Dauntlesses*, spraying the runway and hangars with machine-gun fire—all kinds of swell experiences that the ordinary, or stodgy, type of Naval aviator never gets.

Some of the available rates can only be made in the fleet with proper application of cockiness, carelessness and judgment (poor).

One example is the rate of Stinker, which is awarded for disobeying the signals of the signal officer aboard a carrier (Civilian pilots make this rate by disobeying the control tower.—Ed.). You can get set to make this rate by close attention to disunity while practicing field carrier landings. Disobeying a wave-off is about the best way of becoming a Stinker, but only Stinker 1/c is awarded for it ashore. When with the fleet, you make Chief—but quickly.

Probably you think of the signal officer as an inarticulate gent who stands out there all by himself communicating with his fellowman by waving little paddles. But if you don't do what the little paddles tell you to, you will find that the signal officer is one of the most outspoken citizens afloat or ashore. The unbroken flow of invective he will heap upon you will approach the duration of a well-organized filibuster. An interesting experiment, while making Stinker, is to see whether you can make the signal officer madder



CLOSE SHAVE

THE pilot of this *Skytrain*, one of a squadron of transports assigned to the AAF Tactical Training Command, was training in night flying at Yokum, Tex. He nosed upward in the darkness and flew directly into the props of another *Skytrain*. The crash jerked the climbing plane completely around and the pilot, not knowing what had happened, sent the crew chief back into the plane.

The crewman opened the door to the fuselage and was almost sucked out of the gaping hole. All parachutes had been whisked out of the 15-foot section that had been sliced away by the collision. The pilot of the damaged plane flew it in this condition for 25 minutes, returning to the Yokum field where he landed.

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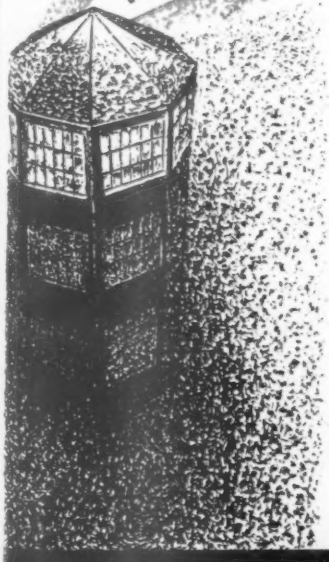

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by ignoring a cut signal or a wave-off. You can even make a sporting proposition out of it and make bets on it.

Another sea-going rate is that of Heel, which you can make only in collaboration with the fighter director. You qualify by failing to comply with his orders, or better yet, by trying to argue with him over voice radio.

You can also make quite a name for yourself by thinking up little quips, or gags, to tell over the voice radio (which also applies to the private pilot). You are always sure of an audience, of course. The fact that the fighter director and the squadron leaders may want to get some information on the air insures their listening closely to you so they'll know when you're through and it becomes their turn.

Another way to be a Heel is by making up your own code and using that instead of the fighter director vocabulary. If your squadron mates don't know what you mean, to hell with them. Let 'em get sharp, so they can keep up with you.

To be more specific, here is a good way to make Heel 1/c. Let's pretend that you are Purple One and the fighter director is himself.

Fighter Director: "Purple One. This is Purple Base. Over."

You: "H'ya, Charley. What's cookin'?"

Fighter Director: "Purple One. This is Purple Base. Over."

You: "Yeah, yeah. I heard you the first time. This is Purple One, right in the pink. Ha, ha. Get it Charley, right in the pink!"

Fighter Director: "Purple One. This is Purple Base. Mattress. Over."

You: "Quit clowning Charley. Mattress over! What are we doin', Charley, makin' beds? I'm no sack-switcher. How about you, Charley, old boy, old boy?"

Fighter Director: "Purple One. This is Purple Base. Vector two five zero. Two bogies. One five miles. Angels ten. Buster. Over."

You: "What's that? Wait a minute, Charley, lemme have that stuff again. I didn't get all the statistics. Just tell me where those characters are and I'll mow 'em down like flies."

One aviator made Zaney under conditions of hardship and considerable privation. He was flying patrol off the Aleutian Islands, and was forced to land due to engine difficulties arising out of the operation of a Japanese 20-mm. cannon. He radioed:

"Am landing in a bay."

This led to a fascinating game of hide and seek, as the Aleutian chain is about 1,100 miles long and the islands contain some 374 or more bays. As a matter of fact, it took his squadron mates 13 days to find him, his radio having gone dead when his plane sank.

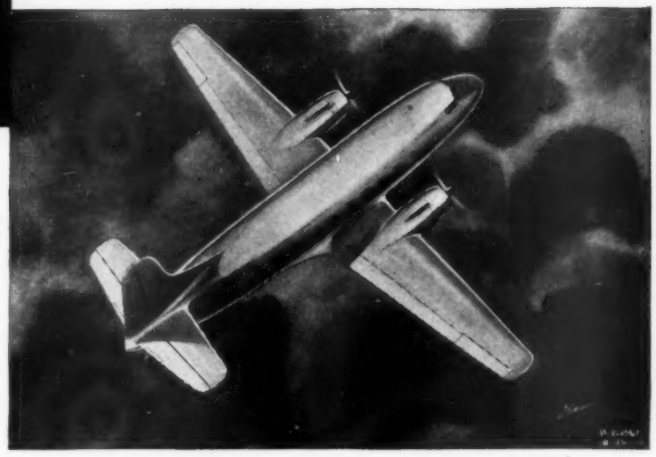
Oh, we could go on for hours about the ways to make these rates. There was one case of a student pilot, whose name became legend but now unfortunately has been forgotten. He distinguished himself immeasurably by making a wheels-up landing despite a running fire of protest on voice radio from the tower. After he had been pulled out of the wreckage and dusted off, his instructor asked him:

"For God's sakes, couldn't you hear the tower screaming at you?"

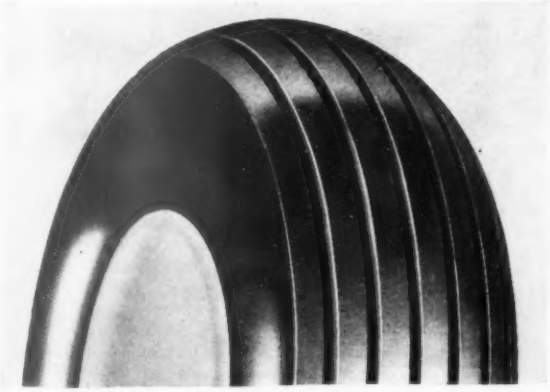
"Naw," replied the student. "Some damned horn kept squawking in the cockpit and I couldn't hear a thing."

The cases cited have been outstanding, but they are not the top-flight cases. Above the rates enumerated there is one which transcends all others! It has been made, but never twice by the same young aviator. Many others have nearly made it. Break enough of the rules, and you'll make it yourself: Corpse 1/c.

THE ANSWER IS SUPERIOR DESIGN



IN THE MARTIN 202—With Braniff, Chicago and Southern, Colonial, Eastern Air Lines, and PCA already "on the line" to fly the Martin 202—and with others scheduled to follow—this new 300-mile-an-hour transport will be plying the airways early in 1947. To achieve superior design, Martin engineers scattered over the major domestic airlines and asked the members of each operational department, "What do you want in an airplane?" The answer is the Martin 202.



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Future Air Traffic Control

(*Continued from page 62*)

itary and air carrier aircraft. Air traffic control equipment carried aboard these planes would be comparable with the minimum equipment required today for instrument flight operation, although installation of a collision warning device probably would be required as soon as practicable. The pilots of such aircraft would not have the benefit of the airborne air traffic control devices and thus would be afforded a lower degree of safety and less convenience than would apply to aircraft in the first category.

Aircraft in the third category will be the large majority of non-commercial civil aircraft having no air traffic control equipment of any kind. These planes will operate only in contact flight rule weather conditions. The minimum equipment required would be essentially the same as that today required of planes not equipped for instrument flying.

The fourth category will include helicopters and similar types of rotary wing aircraft. While it is believed that these types will not come into widespread use much before 1950 it seems reasonable to expect that their development will be well out of the experimental stage by that time, insofar as commercial and private application is concerned. In general, helicopter operation should very closely resemble ground vehicle operation insofar as similarity from a traffic control standpoint is concerned.

First of all, helicopters probably will operate almost entirely by visual contact with the ground. Second, helicopter operation in most instances will be less than 1,000 feet above the ground. Third, as visibility decreases, the speed of the helicopter will be decreased in order to maintain necessary visual contact with the ground and to facilitate the avoidance of collisions.

Thus, it can be anticipated that helicopters generally will navigate by ground marks, and landmarks such as rivers, highways and railways; will remain below the lanes of the faster-moving conventional aircraft; and will avoid collisions by "seeing and being seen" in much the same manner as avoidance of collisions between automobile traffic is accomplished.

The air traffic rules—the rules of flight observed by pilots—must be as simple as possible. For those aircraft equipped with all of the air traffic control devices, instrument flight rules will be greatly simplified as no voice communication between the pilot and ground ordinarily will be required. The pilot merely would have to file his flight plan prior to departure and thereafter follow the indications shown on his traffic clearance indicator and collision warning device. On the other hand, rules of flight for aircraft not equipped with special air traffic control devices probably will continue basically as they are today.

For rotating wing aircraft such as helicopters, only simple rules of flight are anticipated. These rules probably will include stratification and channeling restrictions to keep such aircraft clear of the lanes followed by the high speed conventional aircraft. Rules of the road will require that such aircraft fly to the right when following ground land marks such as highways and rivers and that their speed be reduced in the interest of avoiding collisions as the limit of visibility decreases.

The degree to which future air traffic control procedures are simplified will be dependent largely upon the form that the collision warning device will take. If a perfect collision warning device can be produced which will enable the pilot to see in the worst visibility conditions as clearly as he could see in the best visibility conditions, detailed instructions to pilots probably can be eliminated and a system of regulating the flow of groups of aircraft can be inaugurated similar to systems of controlling automobile traffic.

In this case, the rules of flight probably could be resolved to require that pilots keep to the right side of designated air routes and pass traffic moving in the same direction at least 500 feet to the right. Thus, the pilot of an overtaking aircraft would "see" a slower aircraft directly ahead at the same altitude, and would pull off to the right and go around the slower aircraft. Ascents and descents would be made in the same manner. The pilot would scan the airspace above and below and would climb and descend in such a manner as to avoid aircraft in his proposed flight path.

However, the "ideal" collision warning device is not available and it does not appear that it will be available in the foreseeable future. Collision warning devices known today either will (1) advise the pilot of the bearing and distance of other aircraft in a given hemisphere or (2) advise the pilot of the relative altitude of other aircraft within a limited vicinity.

Assuming that the second approach will prove more acceptable, especially from an economic standpoint, how would such a device affect air traffic control procedures? Its first and probably most important benefit would be to eliminate the necessity for two-way radio communication between aircraft and ground during those times when aircraft must be "laddered" up and down en-route and while departing from and approaching airports. This is one of the most tedious phases of air traffic control and at the same time offers possibilities for delays and errors which can lead to potential collisions. With a vertical separation indicator on board each aircraft along the lines of the current development of the CAA, all of the conversation now involved in "laddering" would be unnecessary as each pilot would maintain the required vertical spacing between his aircraft and other aircraft above and below merely by reference to his separation instrument.

Another important feature of the vertical separation indicator is its value as a safety device in permitting the pilot to double-check his altitude assignments constantly against possible conflict with the altitudes of other aircraft. Should an error be made on the ground or should a pilot misunderstand or fail to comply with instructions, this device will give each pilot a tool with which he can safeguard his own particular aircraft.

Regardless of what traffic control devices are developed, it is expected that channeling of aircraft still will be required. This is especially true in connection with regulating the flow of traffic into airports. Aircraft will have to be brought to the instrument landing system serving each runway in use by landing aircraft at a particular airport. A holding fix on the runway localizer will serve as a "marshaling point" and aircraft will proceed from this fix to the airport in an orderly, closely-timed sequence. With a suitable collision warning device in the aircraft and scanning screens in the airport traffic control towers, it should be possible to permit the landing of aircraft under instrument weather conditions at intervals of approximately 50 seconds on a given runway. Attainment of this objective would mean that air traf-

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During her pre-Army career, Corporal Lupton was variously an exhibition motorcycle rider, operator of a trucking company, owner of a charter plane service and an exhibition parachute jumper. She has logged over 1,100 hours.

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fic would be moving during poor weather conditions with the same frequency possible during good weather conditions.

Since all air traffic must land and take off at landing areas, it is important that these areas be arranged so as to permit their maximum utilization. Use of airports by conventional aircraft is expected to be the major problem in this respect as landing areas for helicopters and other rotary wing aircraft do not appear to be a problem of major magnitude. When helicopters come into general use, landing areas probably will take the form of small plots of land along highways, near filling stations, on farms and in back yards. Landing areas in congested districts may be provided on the roofs of buildings and in parks. Conventional airports probably will have areas set aside for use by helicopters.

Airports for conventional aircraft should be designed to allow the flow of traffic to and from the runways and on the ground in the most efficient manner possible. When the capacity of an existing airport is reached and no further expansion of the airport is possible, it is obvious that an additional airport will have to be established if the community concerned is to accommodate greater air traffic. Thus, it becomes necessary to develop a multiple airport system, which introduces many air traffic control problems.

In developing additional airports for different types of traffic, the type of each airport should be predicated on its expected use. Obviously, a quadruple runway system airport should not be provided for a small number of training aircraft, and neither should a municipality expect to accommodate a large volume of scheduled cargo and passenger traffic on a cow pasture. The designs selected for each type of activity should be the most economical, considering all factors, consistent with air traffic control efficiency and future expansion requirements.

Planning a multiple airport system requires that first consideration be given to insuring that there is no conflict between the contact traffic patterns of the various airports. Contact patterns for the large terminals may require as much as a seven-mile radius while those for the small, non-runway airports may have as little as a one-mile radius.

In addition to locating airports so that conflict between the contact traffic patterns is avoided, consideration also must be given to avoiding conflict between the instrument traffic patterns for those airports served by instrument navigational facilities. The airspace included in the instrument traffic pattern is that utilized by aircraft holding on the runway localizers awaiting clearance to land.

Another requirement in locating airports in a multiple airport system is to provide approach lanes to the various airports so as to keep en-route or "through" traffic clear of local airport traffic patterns. This means that instrument navigational facilities used by aircraft to reach the airport should make possible flight directly to the airport, after which the pilot may circle the airport and land if weather conditions permit a contact approach, or proceed out the instrument landing system and make an instrument approach, if weather conditions so require.

Thus, it seems reasonable to assume that proper design and arrangement of airports, together with automatic air traffic control devices and improved control procedures along the lines suggested herein, should make possible ultimate attainment of the long range objective for air traffic control expressed in the beginning of this article.

As air transportation becomes global, it is increasingly apparent that world-wide standards for the control of air traffic ultimately must be established. An airplane flying from Moscow to Chicago, for example, would pass over areas under the control of at least seven different countries. Obviously, if each country had different systems of air navigation, different flight regulations and different systems of air traffic control, an extremely difficult, if not impossible situation would result.

It is believed, therefore, that one of the most important phases of post-war planning for aviation is planning world-wide standards for air traffic control. Such planning should include navigation standards, communication standards, aircraft equipment standards, standards for flight rules and standards for air traffic control procedures. Much progress along these lines already has been accomplished. Further steps to activate these plans will be undertaken by the Provisional International Civil Aviation Organization.

If long range planning effectively encompasses both domestic and international air traffic control problems, it may be expected that air transportation *will* be able to develop to its fullest potentialities in the future without being retarded insofar as the control of air traffic is concerned. END

AOPA News

(*Continued from page 74*)

whether to complete the approach or to pull up. Secure in the knowledge that he is being checked by a ground observer who has an absolutely accurate indication of the plane's position at all times, the pilot can fly with more confidence and self-assurance.

"There may be pilots who object to having someone on the ground tell them what to do but this is not a real objection to GCA. Experienced instrument pilots are natural-born conservatives who never like to gamble unless the odds are overwhelmingly favorable. I believe the only criterion they will use in judging various systems of instrument approach and landing will be that of safety and dependability. A good pilot would no more insist on 'doing it all himself' than he would fill out his weather clearance himself by the feel of his bones instead of consulting reports made by the weather station.

"It is gratifying to see the AOPA take an active interest in this and other questions of concern to the private pilot. I look forward to each issue of the AOPA *Pilot*. Sincerely, AOPA 17327." END

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Arctic Doctor

(Continued from page 63)

pack and rig your chute, physical exercises to strengthen ankles and legs and the like. But once you take the air the resemblance ends. Where the Fort Benning course calls for jumps to be made at varying altitudes into open fields, our course called for jumps to be made into trees and the slopes of heavily wooded mountains. Our jumps were made from around 2,000 feet, while Army paratroopers usually jumped from an altitude of between 700 to 1,000 feet. Unlike the paratroopers, we did not have to get to the ground in the fastest possible time. We doctors were being trained to jump into wild and otherwise inaccessible places in the northlands to rescue downed flyers. We used a larger parachute which was more maneuverable, enabling us to guide our fall to a certain degree."

The Missoula course took about a month to complete. Before he was graduated Captain Gregory made seven parachute jumps at the school and later made two more in an exhibition at Denver. Since arriving at Nome, however, he was never called upon to jump in the execution of his duties.

"The terrain around Alaska was comparatively flat and treeless and during most of the year it was frozen over," he explains. "If we could fly at all we could usually land the plane on the surface of a frozen lake or, in summer, on floats in a river or lake. This gave us the opportunity to bring the patient out with us for care in a fully equipped hospital at Nome. In the region to the south where the terrain is heavily wooded, doctors made scores of jumps.

"A doctor from Whitehorse jumped at night in heavily wooded country to administer aid to a soldier whose face had been badly burned in a gasoline explosion. Captain Jacobs, base surgeon at Fort Nelson, had over 20 jumps to his credit and was awarded the Air Medal for his exploits.

The nine weather and communications posts Captain Gregory had under his medical jurisdiction usually were located in villages of Eskimos and he was the only doctor to reach the communities on a reasonably regular schedule. His "practice" usually consisted of giving inoculation shots to the seven or eight soldiers stationed at each base and then spending the rest of the time treating the natives for everything from toothaches to fractured skulls. He tried to visit each of the outposts at least once every six weeks although he was on call to any of them by radio for any emergency, military or Eskimo.

"The Eskimos were truly appreciative of anything we could do for them," said Captain Gregory. "I had my doubts when I first arrived. I was attending a sick Eskimo at Wales to the north of Nome and one day the chief of the village came over and started a conversation with me. It was something like this:

" 'You are a very good medicine man. The natives all like you. But you better be good. Once we had a medicine man here. One of the men had a streak of bad luck. He could only get one fish where the other men of the village would get 20 and 30. He would only get one fur where others would get 30 or 40. Finally one day this man decided that the doctor was casting a spell about him and he followed the doctor to see if he couldn't find some way to change his luck. That night the man came back to the village and told his fellow Eskimos that the medicine man was no good. "When I shot him he die just the same as rabbit." ' "

This was supposed to have happened 50 years ago but Captain Gregory said he still didn't take any chances. "I always gave them an extra good going over at that village."

Eskimos are grateful patients, as indicated by the room-full of gifts that had been showered upon Gregory for his work with them. Often the natives, not knowing his name, would send a gift to a trading post addressed only to the doctor in care of the number on his plane. One couple named their baby after him and another wrote this touching letter of appreciation:

"Dear Capt. Gregory: I am thank you for my wife. Because you help blood plasma by plane. I hope you get this letter to you this month. My wife she thankful from you big help."

One winter day the Captain received a radio message that a native Eskimo woman at Koyuk, a weather outpost harboring four American soldiers, was suffering from a severe breast abscess. His pilot, Lieut. James F. Millerick, of Sonoma, Calif., and Captain Gregory flew to Koyuk in an amphibious *Valiant* liaison plane. The woman had a six-week-old baby which was covered with impetigo, a skin disease, which had spread to the mother, infecting her. The weather was bad and the ceiling was down to less than 500 feet but the woman and her baby were loaded into the plane for the return flight to Nome.

"An L-1 is only a little bigger than those Piper *Cubs* you used to see flying around before the war," Gregory recalls, "and we were slightly overcrowded on the return flight. I held the baby on my lap and filled up an empty whiskey bottle with canned milk and fed him all the way back to the base. We gave the mother morphine and she slept all the way."

Modern surgery and clean surroundings soon had the Eskimo mother and her baby back on the road to recovery.

He has aided the natives in countless other ways. During a diphtheria epidemic on the Steward Peninsula he supervised the dropping of diphtheria anti-toxin to a score of scattered Eskimo villages, thereby saving hundreds of lives among the natives.

Captain Gregory likes to tell the story of the aged Eskimo who came to him with a toothache.

"Doc," said the Eskimo, "you good man. You pull quite a few Eskimo teeth that white man has spoiled when they brought in candy and sweets."

"I couldn't argue with him on the truth

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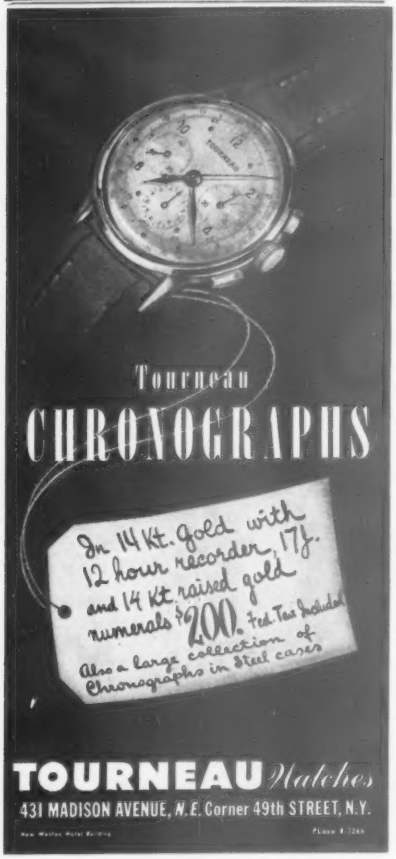
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on that one either," Captain Gregory says.

"The one thing I deplore most about the natives is their habit of never picking up or putting away anything," Gregory relates. "If they are working on a boat and it is time to quit, they just let their tools drop where they are and go home. If it snows or rains during the night the tools are ruined. It is the same around most of their homes. Sometimes the sanitary conditions were pretty bad and I had to keep up a continual program trying to get them to improve themselves. I had some minor success. Once when I was leaving a village, an Eskimo tugged at my sleeve. He had a grin all over his face and he was as proud as punch about something.

" 'Today I did just like white man,' he told me. 'I picked up all my tools after I finished work.' "

Never knowing exactly what he would encounter when he made one of his aerial swings around to the native villages, Gregory usually took along two or three different medical kits. One he had fixed up with the medical equipment necessary to handle fractures, burns, severe lacerations and bleeding. Another was for inoculations and routine medical treatment. Corp. Charles Reed, Akron, O., a surgical technician, usually accompanied him.

"I've heard a lot of tales about how the old-fashioned country doctor used to go dashing across country in his buggy in the dead of night to answer a sick call," Gregory said, "But I bet he never had the problems we had to meet. A call comes in from a native village a couple hundred miles away. You stagger out through a snow storm to the airstrip and help the pilot get the canvas wing covers off and then stand around and shiver while he runs up the engine. You then ride to the village atop a couple of gasoline drums in the fuselage. After you have helped unload the plane, you can go and see your patient. I had to be a mechanic and a jack of all trades just to get to my patient."

The extremes of weather furnished sharp contrast. In July the mosquitoes get so thick inside the plane they comprise a definite visual hazard in trying to take off or land. Once, while flying in an ambulance plane at 30° below zero and at 8,000 feet, the plane made a steep turn and the entire plastic roof of the cockpit, having become exceedingly brittle with the cold, collapsed. Often the cylinder head temperature got so low that the plugs wouldn't fire properly.

Because of the varying weather and the wide territory, with its contrasts in people and terrain no month could rightly be called typical. But the month of March, 1945, as recorded in Captain Gregory's diary, does furnish a general idea of the wide variety of duties he was called upon to perform. He is inclined to use the word "routine" frequently throughout this journal, but one learns that a "routine" day for him at Nome hospital was what the ordinary Army doctor would call an extra busy day. During that month he traveled more than 10,000 miles by air. Here is March, 1945, as he recorded it:

March 1. Flew to Cape Prince of Wales, the last point of land over which planes fly on their way to Russia. From here you can see across the Bering Straits to Siberia. Eleven weather and communications men are stationed there and I gave them immunization shots for typhoid and smallpox. Also made a sanitary inspection. First visit here in five weeks. Treated two colds and a boil on a sergeant's posterior. A native from the village had an old broken wrist and I put a new splint on it for him. Then I flew right back to Nome.

March 2. Completed 28 monthly reports, a job I sincerely hate. Received a report of a soldier suffering from appendicitis at White Mountain. An Interior Department nurse of the Indian Service was on the scene and I talked to her by radio and advised her of steps to take. The weather was bad and we couldn't take off in the plane.

March 3. Weather still bad and couldn't fly. Talked to the nurse again on the radio about the soldier patient.

March 4. Still bad weather. Light snow. Talked to White Mountain nurse again by radio.

March 5. Flew to White Mountain and evacuated patient in a *Norseman* on skis. Plane stuck in the snow on the take-off so we all had to get out and push, except the pilot. Patient was very sick but even so he sat out in the open door and once we got the plane moving helped to pull the rest of us inside. A cable was stretched across the end of the field. We couldn't get over the top of it so we flew under it. Whew!!! A close one. Operated on the patient that night in hospital in Nome. He will recover.

March 6. Made inspection tour with division veterinarian. In afternoon flew to Fairbanks with station hockey team. (Captain Gregory was the player-coach.) Played three games there on Saturday and Sunday. Between games went on a search in a *Catalina* for a lost soldier near Point Barrow, some 400 miles north of the Arctic Circle.

March 13. Returned to Nome.

March 14. Routine, paper work.

March 15. Flew to Moses Point and talked with nurse there who had TB-pneumonia and was critically ill. Went on down to Unalakleet and gave smallpox and typhoid immunization shots to soldiers. School teacher and her husband both had infected ear drums so treated them at the local school. Saw Charley Traeger, local trader, who has long been suffering from diabetes. Then flew on to Koyuk. Gave immunizations and saw a score of natives suffering from broken arms, pneumonia and various types of skin ulcers.

March 16. Routine paper work. Got a wire from Kutzebue that they had a native boy with an eye injury, with the iris protruding out of the eyeball. White Mountain radioed they had a critically ill native, possible diphtheria. The weather was bad, we couldn't fly. Inspected crash equipment at the field.

March 17. Flew to White Mountain. Native had a severe case of diphtheria. Gave him 80,000 units of anti-toxin and restricted the whole village. The weather was very bad. We flew in an overcast all of the way and landed blind. I sure

thought this was it but Millerick got us home okay.

March 18. Played Anchorage at hockey and lost 10-2.

March 19. Routine.

March 20. Routine.

March 21. Got a wire about Lava Lake patient. Not many particulars.

March 22. Men at Lava Lake had worked all night with a bulldozer to clear a runway on frozen lake so we could land. A civilian employee had been badly burned when a gasoline compressor blew up. We evacuated him to the hospital at Nome but he died.

March 23. Flew to Moses Point and saw a Russian interpreter who had acute bronchitis. Treated him there and flew on to Point Spencer and American River, giving immunization shots and making sanitary inspections.

March 24. Routine until late afternoon. Radio from Lava Lake saying civilian cook there had a bone in his throat and was running a 102° temperature. Weather was bad. Finally evacuated him in liaison plane but we had no instrument at Nome to perform necessary operation. Our PBY was set up for evacuation flight and we took off when weather lifted a bit at 10:30 p.m.

March 25. Flew patient to Seattle, administered penicillin all the way.

March 26. Left Seattle for *Nome.*

March 27. Arrived in Nome.

March 28. Routine.

March 29. Routine.

March 30. American River radioed that soldier there was sick.

March 31. Flew up to American River to treat sick soldier.

And this was a month that Captain Gregory explained hadn't been particularly busy. END

That Old Devil Wind

(*Continued from page* 34)

cles (or ranges) changes too. The following list indicates the new relationships which these changes involve:

When wind per cent of air speed is	10	20	30	40	50
Ratio of courses wind will help is	48.6%	47%	45.3%	43.6%	42%
Ratio of courses wind will retard is	51.4%	53%	54.7%	56.4%	58%

It is impossible to break even with the wind. It will never average out over a period of time unless the circumstances are very unusual. The navigator who does not try to gain favorable winds at every opportunity will find that the winds cause more loss than gain. The stronger the winds the more unfavorable the balance becomes. For instance, with a 50 per cent wind 58 per cent of the possible courses will have headwinds and only 42 per cent will have tailwinds.

Another convincing argument that headwinds are more prevalent than tailwinds is to show that the time for any round trip is increased by any continuous wind condition over what would be expected with a calm.

To illustrate this fact two examples are given. In each case a round trip is made from "A" to "B" on a course of north and return. The distance from "A" to "B" is 100 miles and the airplane is assumed to have an airspeed of 100 m.p.h. In the first case a 30-m.p.h. wind is blowing from the north continuously. In the second instance a 30-m.p.h. wind is blowing from the west. The manner of determining total round trip flight time is given for each case.

Round-trip time with 30-m.p.h. north and tailwind.
Ground speed with headwind = 100 −30, or 70 m.p.h.
Ground speed with tailwind = 100 + 30, or 130 m.p.h.

Flight time, A to B, $= \frac{100}{70}$ = 1.428 hrs. = 86 min.

Flight time, B to A, $= \frac{100}{130}$ = .769 hrs. = 46 min

Total flight time— 2.197 hrs. = 132 min. or 2 hrs. 12 min.

The reason for this effect is that the wind has more time to carry the plane back in a headwind than it has to carry it along when flying with a tailwind. For instance, in the examples given it requires 1,428 hours to go from "A" to "B." In this time the wind carried the plane back 43 miles. When going from "B" to "A" the time was only .759 hours and wind carried the plane forward only 23 miles. This made the plane travel 20 miles more through the air than it would have had to if there had been no wind affecting the flight.

Round-trip time with 30-m.p.h. side wind (mathematically the ground speed both ways works out to be 95 m.p.h.)

Flight time, A to B, $= \frac{100}{95}$ = 1.052 hrs. = 63 min.

Flight time, B to A, $= \frac{100}{95}$ = 1.052 hrs. = 63 min.

Total flight time— 2.104 hrs. = 126 min. or 2 hrs. 6 min.

The reason for the difference in computed average speed is again the fact that the wind hinders the progress for a longer time than it assists it. It has already been shown that the round trip time of an airplane with a headwind and tailwind condition is more than for a no-wind condition. Thus, by using the round trip time for the first case cited, the airplane is made to seem slower than it actually is.

Flight time per mile, A to B,— 51.5 sec.
Flight time per mile, B to A,— 27.5 sec.

Flight time per round-trip mile— 79 sec.
Average time per mile —79/2— 39.5 sec.

Ground speed = $\frac{3600 \text{ sec. (1 hr.)}}{39.5 \text{ sec.}}$ = 91 m.p.h.

By using the actual speed in each direction and taking the average of the two the effect of the wind is correctly eliminated and the correct air speed of 100-m.p.h. is obtained.

Air speed per mile, A to B $= \frac{3600 \text{ sec.}}{51.5 \text{ sec.}}$ = 70 m.p.h.

Air speed per mile, B to A $= \frac{3600 \text{ sec.}}{27.5 \text{ sec.}}$ = 130 m.p.h.

Air speed per round-trip mile = 200 m.p.h.
Actual air speed = 200/2 = 100 m.p.h.

When an airplane is forced to make a trip in strong headwinds, therefore, it is desirable to get the trip over as soon as possible to cut down the time the plane is carried back by the opposing winds. To

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do this, it is necessary to increase speed. However, the increase of speed cannot be very large because of the ratio of increased horsepower and fuel required. The power required in fact varies with V^3. If one desires to double the speed of a plane it requires $2\times2\times2$ or eight times as much power. Airplanes are usually operated with 50 per cent to 70 per cent of full engine power at cruising speed. Let us suppose an airplane which cruises at 100 m.p.h. uses two-thirds of its total of 90 h.p., or 60 h.p. To make this plane travel 10 per cent faster or 110 m.p.h. will require ⅓ more power, or 80 h.p. The following table shows approximately how much the air speed should be increased in various per centages of headwinds to get the most efficient operation for maximum range.

Headwind per cent of air speed	10	20	30	40	50
Per cent increase in air speed	1.6	4.0	6.5	9.3	12.0

Where tailwinds are concerned the matter rests largely on whether the pilot is in a hurry to complete his trip or can be leisurely about it. The gain he makes depends on how long he wants to prolong his trip. When less power and speed are used a greater free ride is obtained and the engine operates more economically. Fuel consumption rate will continue to drop with lowered speed to a point where 40 per cent of the power is being used. Below this there is little saving in fuel. Another point to consider is that time between overhauls is increased when an engine is operated for as much of the time possible at lower power output.

The question often arises as to the relationship of the drift angle to the drift

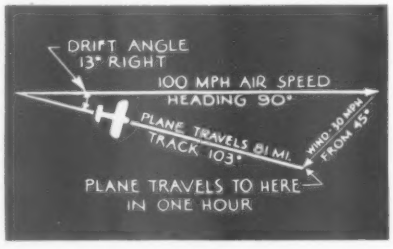

FIGURE 5.

correction in allowing for a side wind in making good a certain course. When is a drift correction greater than the drift angle and when less? Can the drift angle be used for the drift correction with reasonable accuracy?

Let it be assumed that a course of 90° or due east is to be made good and a wind is blowing from the left 45° from dead ahead or from a true direction of 45°. In Figure 5 the navigator is assumed not to know that the wind exists and steers due east. He is therefore drifted to the right. In Figure 6 the wind is known and the plane headed the proper number of degrees to the left of east to correct for it. This illustrates the difference between a drift angle and a drift correction.

The diagram (Figure 4, page 34) shows the relationship of drift angle to drift correction. When the wind blows from a direction where the air speed and ground speed are equal then the drift correction and drift angle are also the same. This direction is shown for various percentages of winds versus air speed and will be found to conform to the table.

All winds blowing from ahead of this neutral wind line cause the drift correction to be less than the drift angle. This

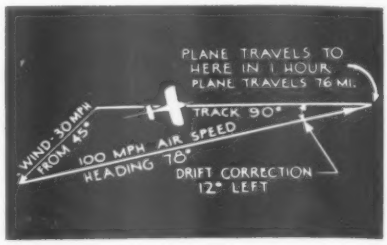

FIGURE 6.

is true because, as the airplane is steered into the wind to correct for it, the wind comes more from ahead and less correction is needed than the airplane will drift. When winds blow from behind this line, turning into them for correction will bring the wind more from the side or beam and cause a larger correction to be necessary than the drift angle.

When an airplane is headed along the desired course over the ground its drift to the left or right can be measured by a drift indicator. The question then, if the airplane is drifting a certain number of degrees to the right of the course, is how much it must be corrected to the left of the course to maintain the desired path over the ground. This table shows relationship of drift angle to drift correction for a 20 per cent and 30 per cent wind.

Wind Degrees From Directly Ahead	20 Per Cent Wind		30 Per Cent Wind	
	Drift Angle	Drift Correction	Drift Angle	Drift Correction
30°	7°	6°	11°	8½°
60°	11°	10°	17°	15°
90°	11°	11½°	16½°	17°
120°	9°	10°	12½°	15°
150°	5°	5¾°	7°	8½°

Here are some of the simpler rules for converting drift angle to drift correction:

1. If drift is left, correct to right and vice versa.

2. When winds are directly from one side or abeam or within 15° either way of abeam the drift angle and drift correction can be considered the same.

3. For 10 per cent winds the drift correction and drift angle can be considered as equal.

4. For 20 per cent winds subtract 1° from drift angle for winds ahead and add 1° for winds behind abeam.

5. For 30 per cent winds subtract 2° from drift angle for winds ahead and add 2° for winds behind abeam.

6. For 40 per cent winds subtract 4° from drift angle for winds ahead and add 4° for winds behind abeam.

7. For 50 per cent winds subtract 6° from drift angle for winds ahead and add 6° for winds behind abeam.

The pilot who takes his winds as they come and flies without due regard for them is incurring two important handicaps:

1. He runs the risk of falling short or

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overshooting his destination or being blown off the course.

2. Because the winds far from average out over a period of time and prove more adverse than helpful there is a needless loss of time plus extra wear and operating expense. It eats into the profits of a commercial company and reduces the life of military equipment and wastes valuable fuel.

With a little understanding and care the winds can be turned to a large asset. By picking out the most favorable or the least unfavorable winds for every flight a great advantage will be gained over willy-nilly operations in whatever condition presents itself.

The most logical step, of course, is always to obtain winds aloft information from the U. S. Airways Weather Bureau before taking off. This information is compiled at individual stations and then teletyped for general distribution to all stations. The information is obtained by sending a gas-filled balloon aloft which will rise at a known rate and observing it from the ground with a theodolite to see which way it drifts. By a special triangulation method it is possible to get the wind direction and velocity at any altitude where the balloon can be seen. The observations are taken four times daily at 0400, 1000, 1600 and 2200 Greenwich time.

The wind information is put into code form and the winds are given for each 1,000-foot interval of altitude above sea level. For stations located above sea level reports are given for the first 1,000-foot level above the surface of the station. The wind directions are given to the nearest 10° interval and velocity is in m.p.h.

The question naturally arises as to how accurate these reports are for a six-hour period. The answer is that they are more than adequate for navigation purposes provided there are no frontal conditions moving over the area to be traversed by a given flight route. It is well known that the wind shifts abruptly in direction 90° or more along a cold front and as this front moves over the earth from 20 to 30 m.p.h. it will cause changes in wind direction as it progresses along. This makes it important for the pilot to take a good look at the weather map at the same time he gets the winds aloft information. It is best to inspect the weather map before any trip. When the airplane is equipped with a radio receiver it is convenient to get the latest winds aloft information while en route.

For the novice, here are some of the more general facts concerning wind which may stand him in good stead:

Weather Bureau surface wind observations are taken at an average of 30 feet above the ground.

Over land the winds tend to double in velocity from the surface up to about 1,500 feet. Over water they increase only 10 per cent. Velocity tends to continue increasing with increasing altitude up to the stratosphere.

Winds generally change direction clockwise with increasing altitude in the northern hemisphere, counterclockwise in the southern hemisphere.

Between 30° to 60° Lat. north and south the winds prevail from southwest to northwest at altitudes usually above 5,000 feet.

Between 0° to 30° N. Lat. the prevailing winds are from the northeast at altitude. For the same S. Lat. the winds prevail from the southeast.

Headwinds usually can be reduced by flying at a lower altitude. In extreme cases, where essential to complete a trip without running out of fuel, flight at altitudes down to 100 or 200 feet above the surface will increase the airplane's range. This is in violation of the 500-foot minimum provided by the CAA and a report of the necessity of such violation would have to be made. END

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Engine Do's and Don't's

(*Continued from page* 65)

over the last peaks approaching the high Denver airport and nursed his plane to a landing with his engine running weakly.

A Denver mechanic pulled the plugs and—you guessed it—"Dirty!" Joe Mechanic got suspicious and began to look things over. He discovered a pinhole in a high tension cable that was leaking badly, decreasing the electrical pressure of the entire ignition system. The low resistance of new, clean plugs permitted a spark to cross the gap. But as the plug electrodes burned away, widening the gap and increasing the resistance, more and more electrical pressure "leaked" through the pinhole in the high tension cable. The resultant poor combustion completed the sabotage on plugs that were in no way to blame.

In analyzing apparent spark plug trouble, remember that plugs are not moving parts. They are carefully designed to receive a high tension current and feed it as a hot spark across the electrode gap. If the high tension current is reaching the plug terminal unimpaired, and if the carburetor mixture permits complete combustion, plugs will seldom go wrong within the normal span of their life.

A logical check-off list for spark plug inspection will involve four questions:

1. Will it pass the prescribed electrical tests?
2. Is it clean and free from moisture?
3. Is the gap setting correct?
4. Is it the plug type specified for the engine in which it is being used?

If the answer is "yes" in all cases, it is foolish to throw the plug away. Regard plug trouble as a symptom and search elsewhere for the primary trouble cause.

Magnetos and magneto ground leads are engine accessories on which a lot of do's and don'ts have been established. *Do* leave the magneto alone. *Don't* over-lubricate the cam. *Don't* disconnect magneto ground leads.

Magnetos contain a few moving parts, a permanent magnetic field and will seldom go wrong during normal operation. When a "mag" does become defective, it is beyond the average ken and facilities of the mechanic to correct the trouble. This resolves into the simple maintenance rule—*do* leave the magneto alone.

The one magneto maintenance function often overdone is lubrication of the magneto cam. Oil is one of the best insulators known and the magneto is, after all, an electrical generating unit. It is far better and safer to under-lubricate rather than over-lubricate magneto cams. A happy medium is to apply just enough lubricant to dampen the oil wick. *Don't* over-lubricate.

The average mechanic would consider it an invitation to suicide to spin the propeller during engine adjustment with the ignition switch in the "on" position. Yet hundreds of cases are on record where the mechanic has disconnected the magneto ground lead, then turned the propeller during subsequent adjustment operations. The net results may vary from badly ruffled dignity to as neat a job as the guillotine ever turned out. A disconnected magneto ground lead is the same as turning the ignition switch to "on." *Don't* disconnect magneto ground leads.

Magneto ground terminal plugs come in different lengths and generally are not interchangeable. Don't worry about a plug that is too long—you can't get it in anyway.

Many pilots, who will hurry to a doctor for a tetanus shot after scratching their fingers on a rusty nail, will make adjustments on their engine carburetor. The chance of developing lockjaw from the scratch is about one in 10,000; the pilot's chance of making the correct carburetor adjustment runs somewhere near the same ratio. This adds up to the simple rule—don't tamper with the carburetor unless you know what you are doing and unless flow bench facilities are available.

An incorrect idle adjustment causes more engine cut-outs during take-off than any other single factor. The "let alone" rule pertaining to carburetors does not mean that field personnel should not make idle adjustments. Instructions for this type of adjustment are included in General Engine Bulletin No. 2, and should be followed implicitly every time an idle adjustment is made.

It seems that breaker points have an almost hypnotic fascination for the average engine tinkerer. This is probably because every time you inspect the points you will find them covered with a uniform black coating. A single "whisk" with a file will make them clean, bright and shiny. Breaker points do not have to be clean, bright or shiny; the black coating does not affect their operation. *Don't* touch the breaker points unless visual inspection reveals pitting, corrosion or badly roughened surfaces. Hand-filed points are seldom flat and the resultant point contact will cause rapid burning during subsequent service.

Contrary to general opinion, the ignition harness is quite delicate and a defective harness can seriously impair engine operation. Cast harnesses are fragile and must be handled accordingly. In general they cannot be disassembled and, when cracked or broken, should be replaced immediately. A sharp edge is liable to cut through cable insulation with resultant grounding of a single cylinder if not the entire ignition system.

Shield-type harness bears careful handling. The insulation is easily damaged by improperly used tools or by bending or crimping the cable too tightly. Don't stretch cables to make them reach; the cable should be long enough to absorb vibration without increasing tension.

The harness-lead-to-spark-plug connections should be carefully made. Never cock the ceramic "cigarette" when inserting it in the mica-lined spark plug barrel. The sharp edge may puncture the insulation and result in a grounded plug. After filling the spark plug barrel and harness sleeve with Dow-Corning compound, allow the excess compound to bleed away before engaging and tightening the connecting nuts. If excess compound is present, tightening the nuts will produce a hydraulic pressure effect that is apt to burst the harness sleeve.

Though the above do's and don'ts in conjunction with engine accessories are by no means complete, they will serve to illustrate the importance of many unqualified instructions found in the average engine maintenance manual.

There is no evidence that this instruction, lifted verbatim from an engine maintenance manual, implies a tremendous amount of cleaning knowledge on the part of the overhaul mechanic—yet the success of the entire overhaul procedure may depend upon strict adherence. Aircraft engine overhaul is usually preventive rather than corrective and a single misstep may nullify all efforts to prevent subsequent trouble.

The opportunity for making such a misstep is dangerously amplified in engine cleaning operations. A single flake of carbon, sludge accumulation or a grease smear may conceal the embryo defect that later will result in a major structural breakdown.

The solution to proper engine cleaning is use of a chemical cleaning agent that will dissolve thoroughly all dirt present and that will not affect the base metal of the part in any manner. However, and this is extremely important, don't use a cleaning agent that is not specifically recommended for the metal of which the part is made.

The three major metals employed in aircraft engine construction are aluminum, magnesium and steel. After engine disassembly, parts made of different metals should be segregated for cleaning. When two metals of different compositions are immersed at the same time in any solution, electrolytic corrosion occurs immediately. Furthermore, different cleaners are required for different metals.

Strongly alkaline cleaners which work well with magnesium are extremely destructive to aluminum; the weaker alkaline cleaners for use with aluminum will corrode magnesium. Steel may be cleaned in either strong or weak alkaline cleaners with cleaning speed dependent on the strength of solution.

One of the most important cleaning operations during engine overhaul is complete removal of carbon from the piston heads. Carbon scrapers are of little value in achieving the latter goal. A good synthetic solvent cleaner will soften carbon deposits so that they may be wiped away, leaving a carbon-free surface for inspection.

The pilot-owner may never be faced with engine cleaning problems. Nevertheless, he should be aware of the importance of proper cleaning and demand that it be done during every overhaul.

Here, then, we have just one of many such "do's," that at first glance seems relatively unimportant. But the engineer who included it in the engine manual was not trying to fill up space. The average engine manual is what its name implies, an instruction booklet giving specific information based on years of experience.

"To avoid engine trouble, mind your do's and don'ts." That's an adaptation of an old adage, but it is mighty practical and healthy. END

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(*Continued from page* 30)

The Army and Navy lost no time when they saw war just ahead. The Army's Troop Carrier Command and the Air Transport Command pulled as many DC-3s from under the commercial airlines as they could and ordered Douglas to start production of C-47s in Santa Monica, Long Beach and Oklahoma City.

Like the gallant ex-civilians who flew her for the services, the DC-3 almost lost her peacetime identity in the war theaters. As she came and went routinely on commercial flights in the United States she was still the same patient, polished, upholstered transport. But beyond the seas she was the olive drab, dusty, beaten, overworked, noisy, uncomfortable C-47 *Skytrain* for the Army, or R4D for the Navy and the Marines. Changes in her model numbers clicked by like figures on a speedometer as the Army made interior or door modifications to meet new needs. As shown in the accompanying chart she was the C-48, C-49, C-50, C-51, C-52, C-53 *Skytrooper*, C-68 and lastly the C-117A. The Douglas *Bolo* (B-18), an Army bomber of the late '30s, was based on the DC-3. So was the CG-17, an Army glider. But there never was a need for major change of structure through her nine-year life.

Listing the battle stars on her campaign ribbons is like a recital of America's military history for four years: the Buna-Gona campaigns, North Africa, aerial invasion of Burma, Guadalcanal, Rabaul, New Britain, Sicily and Salerno, Normandy, southern France, Holland, Nijmegen and the Battle of the Bulge, the crushing plunge over the Rhine to "pay dirt," the Philippines, and at last the landings in the shadow of Fujiyama near Tokyo.

As a troop carrier her primary mission was to drop either glider men or paratroopers on key points behind enemy lines. The three troop carrier wings in the European theater operated solely with the C-47 and C-53 from the beginning of operations until the spring of 1945, when a few of another type were added. Twenty-four paratroopers with their equipment could be carried in the plane, although 18 was the usual number assigned. A heavy wire "static line," to which the troopers' rip-cords were attached, ran the length of the passenger compartment and racks for the parapacks of supplies occupied space along the sides.

Airborne attacks lifted by C-47s and C-53s were strategic cornerstones set in place on D-day, 1944, in Normandy, in the invasion of South France two months later, and in the great flanking maneuver into Holland which began September 17, 1944. The Army's massive exploitation of the new tactic of "vertical envelopment" at some future date may come to be considered as dynamic to military science as the introduction of horse cavalry or the invention of gunpowder.

Throughout the campaign in Europe aerial resupply by the C-47s and C-53s removed space as a limiting factor in the science of logistics and reduced the problem of distance to a simple computation of the time between take-off and delivery point. Similarly in the Pacific, where island bases were days apart by water, the C-47s kept supplies and personnel flowing smoothly at all times.

Statistically, perhaps the most spectacular transport job was done from the English airfields. Thousands of sorties took 2,500,000 gallons of gas in five gallon cans to the 3rd Army in the first two weeks of September, 1944. In the first seven days of October the C-47s and C-53s transported 21,000,000 pounds of ammunition and other freight to the 21st Army group. The 9th Troop Carrier Command had a daily average of 1,084 C-47s and C-53s operating during a seven-week period in June and July, and in that time rushed the lunging ground forces 12,280,523 pounds of rations, mines, ammunition and other combat materiel; carried 19,427 passengers and 24,015 airborne troops and evacuated 11,937 wounded men.

In emergencies, C-47s took off with 40 men aboard. By the time of the descent on Holland the ships were carrying 193 pounds of equipment per man dropped. Cargo capacity was 5,000 pounds plus. As an ambulance it accommodated 24 litter patients.

As glider tugs the C-47s doubled the military punch. Jeeps, dozers, medium artillery pieces and similar bulky surprise packages were wafted to earth in the $18,000 expendable Waco gliders, airstrip or no airstrip.

Not often was the C-47 leading-lady in a more spectacular show than the great glider marshalling operations of the 9th Troop Carrier Command, staged on French airfields in the later phases of the European war. Picture a large field with a long main runway and feeder strips slanting into it like spur tracks at a railyard. On all the feeder strips and along half the center runway the C-47s rest, nose to tail, nose to tail in military precision. Off to one side of each plane, close to the runway, waits its glider. Some have two gliders, a difficult dual tow. From tugs to gliders run the nylon tow ropes, in deep S-patterns, to accommodate their length. Each tow line is wreathed snake-like by the wire of the intercommunications system between *Skytrain* and glider pilots. There are hundreds of planes. This is the American 17th Airborne division.

The space remaining for take-off before the leading aircraft is just 2,500 feet—shorter than the average lightplane field. The leading C-47 has two gliders. The book says, in plain print, that no such take-off is possible in 2,500 feet. The leading pilot lets his idling propellers roll him forward until his tow-ropes stretch taut, then tromps his brakes while he shoves on full engine power, lifts his toes and starts the threesome like a mad horse team down the short strip. First the plane and then the gliders take to the air—just when it looks as though they won't make it. The impossible is done again by the C-47, the 17th Airborne is on its way to Germany—and combat pilots be-

gin to understand about those medals that transport pilots receive.

The "glider snatch" was a daring trick the Air Forces standardized and added to the C-47's repertoire. Intact gliders, left from an airborne invasion, were filled with wounded in the fighting zone and shoved or tractored to the nearest open land. A large loop was made in the glider's tow line and strung between upright poles set in place for the purpose. Over the tree-tops would skim the C-47, just above stalling speed, dangling a cable with a hook attachment. If the aim were good the "snatch" was completed and the glider was jerked on its way toward home. In one 10-day period 148 gliders were thus successfully hoisted out of a landing area east of the Rhine.

Douglas Aircraft records show that 9,649 C-47s were delivered to the Army, plus 186 commercial model DC-3s and 541 C-53s. This does not mean that all these planes are on Army inventories, for many of them were lend-leased to our allies after the Army had taken delivery. Still others were resold to the Navy as R4Ds.

They were the mainstay of the joint Army-Navy-Marine Corps inter-island air transport (SCAT) in 1943 and 1944 in the Solomons. They were used by Naval Air Transport Service both domestically and overseas, and by Marine Air Groups in their own transport systems. The Navy inventories nearly 500 R4Ds, a small number compared with the Army's present listing of 4,650 C-47s, C-53s and C-117s.

The oldest R4D in the Navy, the plushy *Golden Goose*, is still flying after more than 7,500 hours in the air. The NATS pilots at Patuxent River Naval Air Station, Md., call it their "flag plane" because it has carried so much rank—several times its weight in admirals, eked out by a general or two.

But such a respectable career for a DC-3 is like ballet dancing compared with the heavy slogging of the Army's Air Transport Command over the legendary Hump into China, across the cold Himalayas and the jungle mountains of Burma. Many a foray into the jungles was supported and saved by a C-47 or C-53.

The Army tried just about every possible interior modification to expedite the miscellaneous jobs it had for the C-47. The C-47A switched from a 12-volt to a 24-volt electrical system; the C-47B had a two-stage blower for high altitude work; the C-47C was an experiment which put the plane on Edo floats, housing a retractable landing gear. One block of C-47 numbers was known to the trade as the "economy" transport, built as quickly and simply as possible. another block was the "staff" ship, with berths; a third was the "super," the forerunner of the present-day luxury planes for "Very Important Persons." Another group had nine sets of duplicate navigational instruments and was used as a navigational trainer; another contained conveyor belts to speed the dumping of cargo out the hatches in flight—one plane had cargo doors on both sides, with a conveyor belt feeding each and could dump all cargo in five seconds.

But the biggest freak C-47 of all was the XCG-17, a *Skytrain* stripped of its engines and transformed into a glider. Army engineers had worked out paper specifications for an "ideal" glider. Someone looked at their work and said, "that's practically the C-47 without engines." Tests were made after readjustment of the weight to compensate for the removal of the engines. They proved that the converted C-47 could be towed at 290 m.p.h. —nearly 100 m.p.h. faster than the standard army glider. Capable of a payload of seven tons—compared with about two tons for the regular CG-4A glider—its gliding rate was 14 feet of foward motion to each single foot of drop. Other Army gliders rate only 10 or 12 to 1.

This experiment gives a hint of one type of work the C-47 might do as a war veteran. Army pilots who tested the XCG-17 speculated that the future would see ultra-fast freight lines hauling hundreds of weary C-47 "freight cars" behind powered craft.

Other Army C-47s, relatively new, are being bought and reconverted by the airlines for use on feeder runs and on regular schedules until larger planes are available in numbers. Behind this demand is a backlog from corporations and private users who see the DC-3 as their best bet for an economical plane to transport company officials and salesmen.

The last DC-3-type plane was scheduled to roll off a Douglas factory line in March when reconversion work was to be finished on a handful of new ex-Army planes at the Oklahoma City plant. This final plane knows "mustering out" time is here at last—for she'll roll out the door as pretty and shiny a civilian DC-3 as ever purred before a Sunday crowd at La Guardia Field.

The fact that she may look antiquated when she taxis out in the shadow of the Douglas *Globemaster's* mighty wing worries her not at all. She knows that if she's the "old lady" now, she held the center of the stage before more men than any of her twin-decked, four-engined descendants ever will. END

Letters

(*Continued from page* 76)

Cub Cruiser, Ryan, and Taylorcraft. Our rates are $8 and $10 for *Cub* trainer, $14 and $16 for Ryan, and $10 and $12 for *Cruiser*. At present we have hangar facilities for only six planes, but we are building new hangars. Transportation is handled by ferry, bus and train. We have an office as well as attractive recreation and rest rooms.

GEORGE SCHAAF, Manager
Donovan-Hughes Airport
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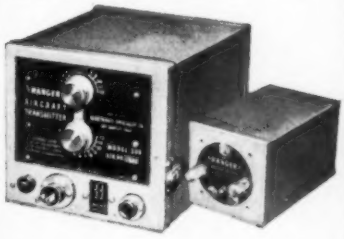

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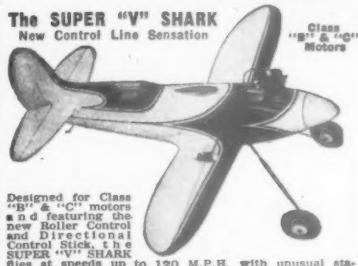

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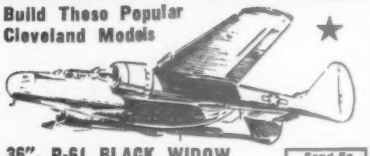

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base was not mentioned in the article.

The fact most highly stressed in your article was the distance of these airports from New York City, also the lack of transportation and facilities offered to the flying public. We are located less than 30 minutes from 41st Street and 8th Avenue by bus which offers service every 15 minutes and stops less than 300 feet from our base.

We have been active as fixed base operators for the past nine years and hold Air Agency Certificate No. 2697 as a Government-approved flying school in conjunction with New York University Ground School. From early 1940 to 1943 we handled primary flight training of 400 Army cadets. At that time we were using 14 trainers on floats and averaged 70 flying hours per day.

In 1943, as the war pilot training program began to decline, we both accepted commissions in the Army Air Forces and closed the business until May, 1945 when the school was again opened.

We own and operate a large metal hangar with sufficient space for 13 seaplanes. There are an office and a classroom adjoining the hangar, also restrooms. Complete shop facilities in a separate hangar are used for repair and overhaul of any aircraft. A new pilot room and lounge, recently constructed, offers a complete library of aeronautical publications, ping pong tables and other recreational facilities.

At present we are using three *Cubs* and one Aeronca. Rates are $10 per hour dual and $8 solo. We are authorized dealers for Piper *Cub* and Republic *Seabee*. Of the 10 *Seabees* promised for early spring delivery, two will be added to the school equipment. Two new three-place *Cub Cruisers* also are on order.

A survey of the airports and seaplane bases in New York and New Jersey show Mellor-Howard Flying School to be the only school owned and operated exclusively by World War II veterans.

WILLIAM E. MELLOR
JOHN HOWARD
Mellor-Howard Seaplane Base
Ridgefield Park, N. J.

● On October 29, 1945, FLYING's New York office mailed over 600 questionnaires to airports in the eastern territory. Thirty-one were sent to airports located within 30 miles of New York City. Of the 31, 18 replied. The reply from Donovan-Hughes airport was received on November 13, 1945—too late for inclusion in the story. Mellor-Howard Seaplane Base did not return the questionnaire at all. Information available indicated it had been closed for at least two years. Pictures of both ports are shown below.—ED.

Mellor-Howard seaplane base and flying school at Ridgefield Park, N. J.

Richmond Flying Service at Donovan-Hughes Airport, Staten Island, N. Y.

'Bomber' Powers

(*Continued from page* 31)

even if he were just out slow-timing a plane, he'd RON from another field. Although it was officially hushed up at the time because it would have revealed the existence of several secret air bases, he once circumnavigated the globe in a *Flying Fortress* by means of four engine changes at fields 6,000 miles apart.

PX never got into the habit of keeping a log book, perhaps because he began flying before he was able to write. As a result, when he applied for admission into the Air Corps in the afternoon of December 7, 1941, he was unable to prove that he actually had more wing-walking time in the air than the C.G. had stick time.

Whether it was his magnificent physique or his needle-pointed mustaches that impressed the C.G., the fact remains that Powers was admitted as a flying cadet immediately. He first made a name for himself the time an upperclassman stopped before him, threw himself into a twanging brace, and ordered him to throw out his chest. The resulting collision between PX's chest and the u.c.'s chin was the subject of much official and medical debate. Cadet Powers was requested not to repeat the action. Upon graduation, the upperclassman was made a permanent co-pilot.

Powers' cadet career was brief and hectic. He was the only man who ever washed out his primary instructor—didn't even let him get off the ground, washed him out for bad taxiing. The instructor insisted on taxiing from the ramp all the way to the runway with three wheels on the ground. Powers insisted that he was over-cautious, a longhair, and had him hailed before the cadet board. The board gave the instructor his choice of going into the infantry as a corporal or going to OCS. The instructor, with acumen usually shown by the type, chose OCS. He spent the rest of the war as a mess officer at Marfa, Tex.

Powers came out of primary a Class V pilot, the first and, perhaps, the only man ever to do that. He was commissioned a second lieutenant but was promoted to first a few weeks later when he landed a *Marauder* dead stick after both engines cut out at 500 feet. The landing was further complicated by a 40-m.p.h. cross wind. He received considerable professional acclaim for this feat but PX always insisted, modestly, that any lucky pilot could do as well.

His first taste of combat was at the Battle of Midway. Powers had just been promoted to captain for his pioneering work in ferrying medium bombers across the Pacific, about which more later. He was at Midway the morning the Jap fleet was spotted to the west. His was one of four *Marauders* that took off that day as torpedo bombers. Each of the other three carried one of the tin fish, but Captain Powers supervised the conventional loading of one torpedo, and then lashed two others under his wings, fashioning a slip-knot that could be released from the cockpit.

His *Marauder* crew was credited with a carrier and two destroyers that day. Not, however, without considerable damage to the plane. Powers had a wizard crew. His bombardier, "Needlenose" Johnson, had memorized all known bombing tables and had worked out a few of his own. He never used a sight—worked out his deflection with a drift meter and set in his bombing angle from his nose to his big toe. He rarely missed. The gunners were hand-picked, the best in the AAF. Pfc. "Daniel Boone" Rockiki in the turret got four *Zekes* that day and Corp. Kit Carpenter got three from the tail, the last with an M1 when a ruptured case jammed his tail gun.

Despite his uncanny flying, Powers' ship was somewhat shot up. There were, by actual count, more than 1,324 holes in the parts of the plane he landed. As he streaked for Midway with 13 *Zekes* on his tail, it became evident that his left wing wasn't going to make it.

With an almost paternal regard for his crew, Powers called the tower and asked permission to make a straight-in approach. Just as the tower told him, "Okay, if you feel you must," his left wing came off at the root. The approach was completed in a half snap, half slow-roll, but using his trim tabs and with judicious gunning of his good engine, PX managed to make the first four landings on Midway after the naval battle. Johnson got a bloody nose and the tail gunner had two front teeth knocked out but other than that it was pretty successful.

There were two sequels to the strike. Despite the crew chief's entreaties, the strip engineering officer insisted on class twenty-sixing (condemning) the plane, and Powers was given a rating as a B-13 pilot, which pronounced him capable of flying half a B-26. According to Maj. Gen. J. Fuddleton Peabody, AAF Historical Officer, this is the only time that rating was ever given. The entire crew was awarded a cluster to the Air Medal they had received for anti-sub patrol off Oakland Bay.

It was while he was stationed in San Francisco that Powers accomplished one of the exploits that make his name famous among hangar flyers.

One evening, early in '42, while he was dressing for a date with his fiance of the moment, Miss Universe of '41, he was called for an immediate take-off. A Jap sub had been sighted a few hundred miles off shore.

Without waiting to change clothes (he was fashionably attired in top hat and tails), Powers picked up his crew, climbed into his plane, warmed up the engines while taxiing and checked his mags on the take-off. An hour or so later, Needlenose reported that instead of the sub he had spotted six Jap transports. Almost at the same instant the word was passed up that, in the rush, no one had remembered to pull the safety pins on the depth charges. Incidentally, as Col. Jean Daugherty of Dallas, Tex., recalls, Powers that day was flying a plane in which the pins couldn't be pulled in flight.

To any pilot but Powers this would have been a catastrophe of the first water. To PX it was a minor annoyance. He pulled up in a screaming climb to

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12,500 feet, making his plans with Needle-nose en route.

The run was made at 12,000 and, at the instant of "bombs away," Powers chopped his throttles, rolled in 85° of flap until the depth charges were in front of him. Then at full throttle he dove after them. With a clean ship and controls locked in place he climbed out onto the wing with the sure-footed nonchalance he had developed during his barn-storming youth. As the plane passed each depth charge, old PX coolly removed the pins. He had estimated a leeetle close and had to hurry back to his seat in time to pull out a bit under 20 feet. There may be nothing to the rumor that he booted the charges about a bit while pulling the pins. But the fact remains that they were so perfectly laid that three of the six ships were sunk and the other three were left dead in the water.

Powers was, by preference, a medium bomber man. He wanted nothing to do with the heavies. There were a few times that he flew 17s and 24s on direct orders, but his heart wasn't in it. Once, in a moment of pique against the Army's insistence on large bombers, he said to his father, "By Gad sir, if they want a BIG bomber, I'll give 'em one that will stop all this chatter." That night he developed the basic designs for the B-29 and the B-32. It is interesting to note that the B-32 bears a more than faint resemblance to his beloved *Marauder*. Another of Powers' inventions showed up in him the little boy that so many women loved. He used to chuckle whenever he told the real reason why he designed the reversible pitch propeller. He cooked up the idea so he could dust off the colonels and brigadier generals who were always getting in front of his plane while he was running it up.

It was probably Powers' early love of speed that made him prefer the medium and light bombers. Any time he dropped below 190 indicated he fell asleep, but he was credited with being able to fly better asleep than most pilots could on a benzedrine binge. He pointed out that all the heavies could do was carry twice as many bombs as their smaller cousins, and that he could make two trips to their one and so even things up. This theory led, for some reason or other, to his being asked to determine if it were feasible to ferry 25s and 26s from Hamilton Field to Hickam Field. This had never been done and there were numerous people willing to point out reasons why it couldn't be done.

He agreed to try, under one condition. He'd fly alone; he refused to risk his crew on such a mission. The condition was allowed and Powers took off by himself early in April, 1942, on the hop that paved the way for the hundreds of *Mitchells* and *Marauders* that later flew the Pacific.

He found a tail wind at 16,000 feet and when he reached the halfway point he rapidly figured that he had 30 minutes more than enough gasoline left to complete the trip. As this appeared ample, he promptly turned the plane over to the auto-pilot, ate a couple of Spam sandwiches, drank his thermos of coffee, and fell asleep.

Powers had George trained to whistle at the approach of danger, but George must have fallen asleep too, for without warning, the plane entered the biggest thunderhead ever charted in the Pacific. Five seconds later the plane disintegrated and Powers woke to find himself swinging from his parachute in the most terrific turbulence he had ever experienced. He had barely regained his senses when he found himself in a violent updraft. It pulled him up through an ice zone and inside of 15 seconds he and his chute were covered with five feet of rime ice. The weight of the ice pulled him down and he managed to kick his feet loose. But again he hit the updraft and again he shot up for another coat of ice. This continued for more than two hours. By this time he had accumulated an iceberg of almost glacial size.

Its weight finally dropped him through the updraft at a rate comparable to the descent of a free chute and he came to rest in the ocean, 900 miles from Diamondhead.

Handicapped by having only his feet free, it took Powers two weeks to kick that iceberg into Pearl Harbor. Once there the Navy blasted him free with gunfire but it took three Navy meals and eight hours of sleep before he was himself again.

In all Capt. Roger Powers flew 151 bombing missions in '42 and early '43. More than 100 of them were flown with the 13th Air Force. He was finally ordered back to the States to rest. It was during this rest period that he did his stint with the ATC. END

What You Should Know About Compressibility

(*Continued from page* 66)

is that compressibility speeds are very elastic and their effects can be felt even when the pilot assumes that he has not yet reached the demarcation line where they begin.

Perhaps in the near future instrument panels will be provided with a true airspeed indicator as well as an absolute altimeter. Until then we must remember that it is easy to be fooled by the low readings of the indicated airspeed. As long as we are on this subject, here is an easy way to calculate the true air speed at different altitudes:

The true air speed is equal to 1.4 per cent of the indicated air speed for every 1,000 feet plus the I.A.S. Example:

I.A.S. = 450 m.p.h. — altitude = 20,000 ft.

T.A.S. = $1.4 \times 450 \times 20 + 450$

$= 126 + 450 = 576$ m.p.h.

In combat maneuvers, however, pilots were apt to watch the enemy airplanes rather than their instruments and before they realized it compressibility effects appeared. They can appear at or about the speed of sound while traveling under one G conditions, or much earlier if more Gs are being pulled.

It really is a vicious circle because if you are in a one G dive and have not yet reached compressibility speed, you certainly will do so if you continue the dive. Or if you do not continue the dive but start pulling out and increasing the number of Gs, you will get into compressibility just the same. There is no question, however, that the sooner you try to pull out the easier it will be and the less altitude you will lose.

On several occasions I started dives at exactly the same altitude and at the same angle of attack and power setting. Approximately a 10-mile increase in speed resulted in a loss of nearly 1,000 feet of altitude. In addition, the plane also increased its diving angle and on several

Photo by Newsday

"We'll soon be licensed A&E Mechanics, Al"

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"Why?"

"If I'm drafted, my training will put me in line for a better rating. If I'm not needed, I can enter commercial aviation as a licensed mechanic. But how come **you're** here taking the course, Bob? I thought you were in an AAF ground crew?"

"And so I was, Al. Many's the bomber we Army mechs tuned up for missions over Germany. The Army taught me a lot about planes—but I didn't get any license out of the deal. And remember, it's the licensed mechanics who are preferred."

"Yes, every aircraft repair station must have a licensed mechanic," answered Al. "All others, no matter how experienced, must work under the man with the license. It's the license that counts."

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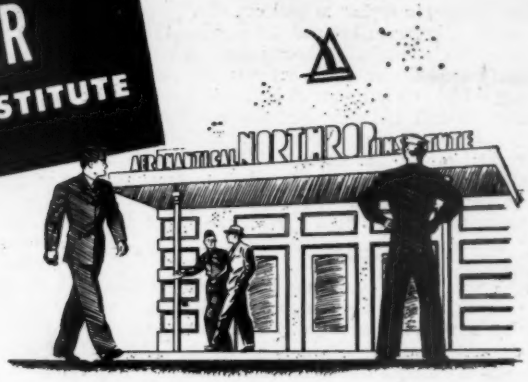

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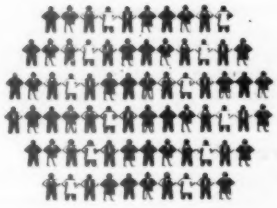

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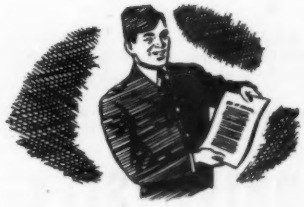

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F-4

occasions it went "under the vertical."

It gives you a very unpleasant sensation when, in trying to pull out at a true airspeed between 500 and 600 m.p.h., you feel the plane falling. Sometimes the tail surfaces shake so hard that you fear losing them. As a matter of fact, this is not a structural buffeting but the result of the tail traveling through highly disturbed air—a disturbance developed by shock waves created around the wing. The more Gs you pull, the less speed you need to get into this condition—a fact which makes it difficult to decide what to do.

If your speed is not too high, reducing power will help. On one occasion, though, this worked the wrong way so the throttle was reopened.

By all means the most efficient results are obtained by using the so-called "dive flaps" installed on the later *Lightning* models. The writer made a series of dives, using exactly the same configuration and trying to put the plane as nearly as possible in the same position with and without using the dive flaps. It is remarkable what a difference the use of the dive flaps will make. On two occasions the elevators' forces were so high that I was unable to pull the stick back. As soon as I applied dive flaps, however, the plane started to come out without it being necessary to pull back on the stick. The buffeting, though, was extremely severe.

On a few occasions a certain yaw appeared. This coincided with a bad rudder trim and obviously was due to unsymmetrical loads on the rudder.

In two instances I did not want to use the dive flaps. I used some elevator trim and continued to apply a constant back pressure on the stick. After reaching approximately 450 m.p.h. at 20,000 feet, the speed stopped increasing in proportion with the loss of altitude and steepness of the dive. At about 12,000 feet altitude the forces suddenly became so light that I had to push to overcome the action of the trim tab. Of course, I was expecting this phenomenon to appear and was prepared to check it. What had happened was that the plane, by not increasing its true speed, came out of the compressibility range when it reached lower altitudes where the true speed of sound is higher.

Recovery from compressibility effects is a rather delicate subject since there is little positive advice which can be given at this time.

All planes able to reach compressibility speeds should be equipped with a device similar to the Lockheed *Lightning's* dive flaps. Otherwise it is up to the pilot to be able to determine the right amount of elevator necessary to give his plane a speed just above the high speed stall velocity and just a little less than the speed already attained.

In other words, he will pull gently but firmly back on the stick and as soon as he feels buffeting symptoms appear he will reduce pressure on the stick slightly and then start pulling again.

In case the elevator forces should be so high as to make it impossible for the pilot to pull the stick back, he might look for help in using the trim tab though it probably will be of no use. If he does so, he must be sure to watch for a sudden tail-heavy condition, when his loss of altitude will automatically bring him out of compressibility range.

In summary, the best way for the student pilot to stay safe is either to avoid stalls or to act as soon as he recognizes their symptoms.

The same goes for "compressibility trouble." We are all more or less students of this phenomenon and the best advice available is to avoid it also. If for some reason, however, we do approach high Mach numbers, the safest procedure is to look for those symptoms which precede reaching the compressibility range. The writer knows only one way to do this: the pilot should be extremely easy on the controls so as to detect the slightest tail buffeting or the slightest change of trim. Repeatedly, and on several different types of aircraft, when the dive was stopped as soon as buffeting under one G conditions occurred, the author had no trouble in bringing his plane out without too much loss of altitude. The true air speed in all cases was above 600 m.p.h.

One of the important things to remember is that compressibility effects are not a function at high speeds only but depend also on the number of Gs you are pulling. Very near the demarcation line you might get in trouble simply by not handling the controls smoothly enough.

As a rule, a pilot can count on some warning if he is alert, and he definitely should not hesitate to start immediately to pull out or reduce the speed.

If for some reason he reaches a point where he hasn't enough strength to pull the stick back, he might try the trim tab —carefully though—and be ready to retrim at any moment.

On the whole, the study of compressibility effects upon flying characteristics is still in its infancy and the only step toward safety at such high velocities is to be found in the dive flap. For the rest, caution and good luck must do. END

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London Letter

(*Continued from page* 59)

gency fields, has every bad weather flying facility, including the largest FIDO (fog investigation dispersal operations) installation in the country. Many crippled aircraft, struggling back from Germany, were saved by the huge concrete surface of Manston. Objection to using it for London is the long railway journey to the field.

Grass Airfield

Grass airfields may come back again for private flying. The London Aeroplane Club, which has started work with W/C J. A. Harris as its chief instructor, is using the grass airdrome at Panshanger.

A fair sized business was built up in Britain before the war for "Hunterising" airfields, as the program was called. This process consisted of re-seeding, rolling, treating and producing a fine, level grass surface, resistant to cutting up by wheels.

Hunterised surfaces took fairly heavy aircraft without damage. The Fairey Airport on the Great West Road (now absorbed by Heathrow) was treated in this way. The result was a billiard table surface which was a delight to use.

New Light Aircraft

The Tipsy light monoplane is to go on the British market again. It is a conventional low-wing plane with side-by-side seating and bicycle and tail-skid undercarriage. It was originally launched by the Fairey Aviation Company but the company now building it is the Tipsy Aircraft Company of Feltham, Middlesex, England. END

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The Farmer Takes a Plane

(*Continued from page 26*)

and give the "kids" their lessons. So determined was Louise to fly that she spent the summer driving a tractor to earn the necessary money.

But the airplane means more to Huntington County farmers than just something to fly. It is leading them to soil conservation—water control—and better farming. It all started when Water Rusk, county agricultural agent, took to the air, camera in hand. Photographing right and left, Rusk, with Wakefield flying him in a Piper *Cub*, has shot more than 200 natural color photographs. These pictures, showing vividly what is happening to the farms of the county, has aroused farmers to active soil conservation.

For years, Rusk, like most country agricultural agents, has been talking with folks by day and holding meetings by night. The story, always the same, was better farming and better farming meant better land use. It wasn't easy. Folks didn't always see their fields as others saw them. Then one day Rusk hit on an idea. Why not photograph the farms in Kodachrome and project the pictures onto a screen at his meetings?

Experimental pictures taken by Rusk, with Wakefield piloting the plane, far exceeded expectations. Plans were made to photograph an entire farm. When Rusk threw the pictures on a screen at his first meeting he knew from the "ohs" and "ahs" that he had at last found the formula for awakening farm folks to the need of soil conservation. Since that time more than 500 interested landowners have flocked to meetings to see pictures of 14 demonstration farms. Amazed and slightly frightened at what they saw, they have taken up soil conservation work with a vengeance—thinks to help of the airplane.

Once a farm family buys an airplane, zeal for flying quickly spreads to every member of the family. The Crane family, who have been growing fruit extensively for five generations in Allegan County, Mich., is a good example. Six of them hold licenses—two brothers, a sister, the father and two brothers-in-law. They are all home except one sister.

The Cranes own a 65 hp. Piper Cub. They, too, have their own field and hangar. Plans now are being made to lengthen the landing strips to accommodate much larger planes. Albert Crane says, "I get a laugh out of these recent stories entitled 'First Fruit Delivered by Air.' I delivered fruit by air direct from our farm to the consumer back in 1943."

In Delaware County, the possibility of an airplane trip with her husband caused Mrs. Lewis E. Reese to shut off her washing machine with the washing only half finished. The tractor had broken down on a busy Monday morning and Lewis called the factory branch at Indianapolis, 60 miles away, to ask them to get repair parts out to the Hoosier Airport so he could fly in after them. One and one-half hours later Lewis was back putting the tractor into operation and Mrs. Reese was finishing the family wash. The time saved on the trip is dollars and cents to Reese, to say nothing of the pleasure of getting a bird's-eye view of how his neighbors are getting along. He owns a 65 hp. Piped *Cub Coupe*.

While most farm pilots range from youngsters to middle age, age doesn't seem to be too much of a handicap. In Decatur County, Farmer Barton McLaughlin, who recently celebrated his 66th birthday, is just about ready to solo. His instructress, comely Betty Cull, who has taught many farmers to fly, says that farm folks make very apt pupils.

These mid-western farmers are already putting into reality the prediction of W. T. Piper, president of Piper Aircraft, that "it is entirely possible that the farmer will lead all of us into universal use of the plane." END

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Report from Washington

(*Continued from page 43*)

estimate carefully the height of obstructions and examine terrain for roughness.

Be alert to the possible presence of wires across bodies of water.

Keep alert to the importance of alertness, especially if you are a crop duster.

Battle of Midway

The Navy recently unveiled for the benefit of the Washington press a film entitled "Report From Tokyo, 1946," showing Japanese naval officers and industrialists being questioned by American naval officers. One of the questions tossed at Capt. T. Aoki, commanding officer of the carrier *Akagi* in the Battle of Midway, was:

"Will you give me your opinion of the relative merits of horizontal and dive bombing in the Battle of Midway?"

The reply, as relayed by an interpreter, was: "The captain says it was carrier-based dive bombers which turned back the Japanese fleet at the Battle of Midway. The Japanese lost four carriers to carrier-based dive bomber attack. He does not believe that high level bombing is effective. He does not recall one hit being scored by high level bombers during the battle."

Curtiss-Lockheed Merger

FLYING has been informed that directors of Lockheed Aircraft Corp. and Curtiss-Wright Corp. are very receptive to the idea of merger and that, notwithstanding several major problems, the deal bringing the two aircraft manufacturers together probably could be closed by late 1946.

Guy W. Vaughan, president of Curtiss-Wright, has decided to retire to board chairman but is reluctant to make that move until a vigorous younger man, such as Lockheed President Robert E. Gross, can succeed him. The companies are in excellent financial condition, with Curtiss having a working capital of 100 millions and Lockheed about 30 millions.

Biggest stumbling block in the way of the merger, according to a reliable source, is the apparent reluctance of Curtiss-Wright, which has moved out of the transport plane field, to return to the manufacture of highly expensive transports in a market that could not underwrite volume production.

Mail Via Helicopter

Southwest Airways has filed with CAB an application for certification of a helicopter mail route to serve 21 communities in the Los Angeles area. James G. Ray, vice-president, has disclosed that delivery can be taken by mid-summer on seven or eight four-place Sikorsky S-51 helicopters. This commercial version of the R-5 military rotary wing craft will have a gross weight of approximately 5,000 pounds and will cost about $50,000. Permissible load will be in the neighborhood of 1,000 pounds.

Base of the mail line's operations would be Los Angeles airport. Both day and night service is proposed. Helicopters would shuttle between the airport and roof of the Terminal Annex post office in downtown L.A., an eight-minute trip, and regular service would be maintained to the other 20 stations in the area.

Southwest sought a feeder line certificate for Southern California last year, but CAB turned it down because of the company's lack of equipment. The second application carries the assurance that helicopters will be available and a statement that Los Angeles postal officials favor the plan.

Chute Shock

The grapevine has it that Switlik Parachute Company has developed a new and rather revolutionary rigging for their chutes. The rigging will make use of rubber shroud lines. Object is twofold: (1) upon opening, whether used on cargo or on flyers, the lines will act as shock absorbers, decreasing initial shock; and (2) upon landing, the lines will contract and eliminate the confusing tangle that is commoplace with conventional type chutes.

Switlik has attempted to keep the project secret but it is known that Edward Boland, the man who made the first jump with a manually operated chute, designed this new job. The idea is not merely an engineer's pipe dream. It was used by the Army on its target planes with quite a bit of success. END

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TRAINER 1941 model, 65 Continental, 85 hrs. since relicensing by CAA, wings recovered with grade A, 250 hrs. on engine since major, 15 hrs. since top overhaul on engine. New upholstering, steerable tailwheel, brakes both cockpits. $1595.00. Wire $300.00 deposit, can deliver for expenses. Sammie Goldin, Phone 93, Marshall, Mo.

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FOR sale: Curtiss-Air Sedan, NC 12314. Aircraft completely rebuilt and recovered. Two-way radio, complete blind flight group, cylinder head temperature, carburetor air temperature. Aircraft finished in insignia blue, yellow trim. Wright R-760. Total time on aircraft 962:50, engine 996:50, time since major 276:00. Hilsen Aero Service, Box 5056, Station C, Spokane, Washington. Phone Glenwood 2745.

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C8D RANGER 145, two way radio, landing lights, flaps, primary blind group. Wings completely overhauled and recovered. A-1 condition, no junk. C. D. Raff, Albuquerque, N. M.

24W9 DELUXE, NC-18683, Warner 145, zero hours since factory $1000.00 Major. Electric Starter, Generator, Sensitive Altimeter, Turn and Bank, Rate of Climb, Receiver and Transmitter, Yellow and Blue Hand Rubbed Finish. Ship in excellent shape, has always been hangared and received excellent care. Selling to buy twin engine ship. Price $6000.00. A. L. Yeager, care of Josam Manufacturing Company, Michigan City, Indiana. Phone 4300.

PT 19-B. LICENSED May 1945. Electric inter-com system, clocks, new, plugs, hoses. 30 hours since periodic. Best offer takes it. Horst Broemme, R.F.D. No. 2, Mt. Holly, N.J.

FOR SALE or trade: 24 C8C Warner 145 Fairchild. 2 way radio. Low time. A-1 condition. Franklin J3 65 Cub. Majored and recovered. Plexiglass windshield. Better than new. Bucyrus Flying Service, Bucyrus, Ohio.

M62A (PT19A), less than 200 hours since complete engine overhaul. Airplane has just been completely overhauled and licensed. All wood surfaces covered with fabric for more speed and better appearance. New tires and complete 2-way electric interphone. Basic blind flying group both cockpits (less clocks). Looks and flies like new airplane. Will deliver reasonable distance for expenses. Price $2100. J. J. Miller, P. O. Box 4098, Albuquerque Army Air Field, Albuquerque, New Mexico. Phone 8845 or 2-3782.

PT-19A, built 8-43, total engine time 400 hrs. since new. Licensed & very clean. Maroon fuselage, yellow wings & stabilizer, $1800. NC 51835. See it at Smithfield Airport, Smithfield, Rhode Island. Contact E. Lincourt, 55 Mapleton St., Cranston 10, R.I.

M-62A, NC 52428, Manufactured November, 1943, 500 hrs. since new. Refinished red with black. Electric interphones. New retreads. Perfect condition throughout. Owned, flown and maintained by A&E mechanic mostly cross country. Periodic complete. DPC $1740 airplane must sell $1600. Tribble Aeromotive, Phone 9980, Kenosha, Wisconsin.

PT-19A. Engine hours 275 since major. Ship completely refinished and in excellent condition. No time since licensed. No better PT-19 for sale anywhere. Price $1500. J. L. Bodie, Pine Bluff, Ark.

HOWARD

DGA-9, four place, 285 Jacobs, no time since major, Hamilton two-position prop. Fully equipped. Flares, two-way radio, navigation lights, airplane completely refinished, and looks like new. All inquiries will be answered. Central Aircraft, Route 6, Little Ferry, N. J. Hackensack 3-2275.

PIPER

J3F-50—DUAL Ignition—dual brakes—fabric good—recent 100 hr. check. Price $1050.00. Will deliver for expenses, Maheux's Airport, Inc., R.F.D. #2, Mechanic Falls, Maine.

J3L65 CUB. One hour since major and complete recovering. Ship like new, $1600.00. Hood Flying Service, Box 254, Blytheville, Ark.

Piper Cub $550, Aeronca $850. Many bargains like these every month. Send 25c for latest listings of used aeroplanes, engines, and equipment located all over the country. "Sky-Pilot," P.O. Box 3197, Savannah, Georgia.

CUB trainer J-3 F-65 twin-ignition Franklin, color blue and yellow, Heath one-piece windshield, steerable tailwheel, muffler. A dandy little airplane, this one won't last long. $1295.00. Wire $300.00 deposit. Can deliver for expenses. Sammie Goldin, Phone 93, Marshall, Missouri.